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ABSTRACT

This book was developed to answer those questions and concerns most often on the minds of students during a mathematics class. It offers them insight from an instructor's viewpoint on how to increase their probability of success in a mathematics course. It is intended to approach the learning of mathematics through both motivating students and giving them insights into mathematics. Chapters include: "A Brief Look at Mathematical Historical Development"; "A Strategy for Success"; "Choosing the Right Math Course"; "Selecting an Instructor"; "The Textbook Purchase"; "Reading Your Math Textbook"; "Using an Alternative Textbook"; "Attending the First Class"; "Attending Lectures"; "Taking Effective Notes"; "Asking Questions in Class"; "Study Groups"; "Doing Your Homework Assignments"; "Preparing for and Taking a Test"; "Mathematical Problem Solving"; "When You Need to Get a Tutor"; "Choosing the Right Tutor"; "Abstraction vs. Distraction"; "Thinking Mathematics"; and "Mathematics in the Professions". (MKR)

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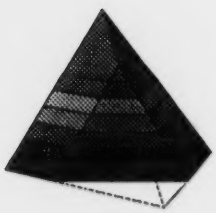

Next Generation Strategies And Information, For *Success* In The Study Of Mathematics.

Joel Greenman

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OH MATHEMATICS!

Mathematical Woes Befit For Those Who Enjoy The Pain,
What Good To Learn It's Rigors And What's To Gain.

To Ponder Thoughts And Dwell On Analytic Tricks,
What Disturbed Mind Developed That Which Never Clicks?

Such Concepts Born From Man's Demands In Ancient Times,
Couldn't He Have Satisfied His Tendencies By Stating Ancient Rhymes?

What Mental State Must We Attain To Conquer Mathematics?
No Doubt That State Is Not Within The Realm Of Human Genetics.

Oh Mathematics! How Shall I Ever Hope To Approach Your Evil Ways?
For I Am But A Simple Being With Finite Learning Days.

A Plan Perhaps A Guiding Light To Allow For Numeric Thinking,
I Seek A Pathway Through The Maze To Keep My Ship From Sinking.

A Logical Approach To Succeed At That Which I Must Do,
The Steps Exist For All To See And Attempt To Follow Through.

My Journey Through The World Of Math Will Have Its Path Defined,
For That Of Which I Had No Strength, I Now Seek With Peace Of Mind.

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Preface To The Instructor

What would it be worth to you to make your job easier and your students better prepared to handle the rigors of your course?

What would it be worth to you to devote your full concentration to teaching and to minimize your response to student questions other than topic related?

I have developed a book which will answer those questions and concerns most often on the minds of your students. It offers them insight, from an instructor's viewpoint, on how to increase their probability of success in your course. It is intended to approach the learning of mathematics through both motivating the student and giving them insight into factors such as:

- Why do we need to study mathematics?
- Enhancing the student's motivation to learn.
- Attitude adjustment.
- Commitment and confidence.
- Choosing the appropriate course.
- Attending lectures and note-taking.
- Changing study habits.
- Preparation for each class meeting.
- Preparing for and taking tests.
- Getting tutorial help.
- Career opportunities in mathematics.

There are many things that we purchase today that come with a manual so that we can successfully operate, put together or maintain the item. From owners manuals for cars and instruction manuals for VCR's to instructions on how to operate a new chronograph watch, scientific calculator or computer. These powerful items, which sometimes complicate our lives, are intended to make our lives easier.

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The knowledge base for the development of each of these items exists, we only need to be instructed on why we need them and how to use them.

Where is the manual that will tell your students how to understand and succeed in mathematics? Where is the manual that will fill in the missing pieces in relation to questions so often asked by students of all ages, about the academic process in general?

This book will fill that gap by providing your students with the necessary information to raise their achievement level. When your students are informed of the strategies that they need to follow and the underlying information base that they need to be aware of, they can then concentrate on the learning aspect.

Especially helpful for adult students, who may have been out of an academic environment for many years and are now required to take a course in math and renew their understanding of the academic process, this book will prove to be an invaluable tool in promoting their success.

This is the type of learning resource that could be used by any student in any math course. It could in fact be utilized by students following any curriculum, since much of the information can be generally applied to enhance the learning process.

Students should now become used to acquiring a learning manual on how best to prepare for a math course in particular and the learning process in general, just as they are used to acquiring a solution manual for their required texts.

The implementation of the techniques presented herein and the information gained by your students will have an overwhelming impact in allowing your students to realize their full potential, given the strategies and options available to them. It will also allow, for you as the instructor, to maximize the satisfaction that you derive from your chosen profession.

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To The Student

After years of teaching, I have met very few students who did not express their apprehension about taking a course in mathematics. Are you one of them?

What is it about math that makes most students avoid it at all costs?

- **Is it the abstract nature of the concepts?**
- **Is it the student's pre-conceived notion in regard to its lack of applicability to the "real-world"?**
- **Is it that too many of us were just never "turned -on" to mathematics at an early age by grade school instructors?**
- **Or is it simply that you never did well in math and no one wants to pursue that which they don't do well at.**

Each of us has our own reason. Here is where some advice on specific strategies that you can use to boost your learning ability in mathematics, can be of significant value. A plan of action to show you what the key elements are in successfully learning mathematics. The information contained herein, can also be applied to developing your personal study skills and academic practices in courses other than mathematics.

If you are presently pursuing a course in mathematics, whatever reason you might have not to like math, must be set aside. A multitude of reasons exist why you need to understand the basic concepts of mathematics to "survive" in our modern world. Increasing emphasis is being placed on mathematical education in both elementary school and college level studies.

An understanding of mathematical concepts is fast becoming an assumed capability on the part of the "average" employer. From accurately balancing your checkbook or buying a roll of wallpaper for your kitchen, to purchasing a car or saving money for your retirement, mathematical methods are employed. An understanding and successful completion of basic math courses such as algebra, has become a requirement in order to obtain a BA or BS degree from most academic institutions.

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Now that I have your attention, let me state the following:

Forget about whatever it is that makes you not like mathematics!

Set aside the fear that you won't do well because you have never done well in this subject in the past!

I have met too many students who thought that they had no mathematical aptitude but ended up doing very well in mathematics.

No longer does mathematics need to be your obstacle but rather your "gateway to success".

As an educated individual you need to understand the basic concepts of math. Your career may depend on it! Many employers now give aptitude tests to potential employees prior to their employment. These tests contain basic mathematical concepts. Employers are not looking for a mathematician, just someone who has a basic understanding of numerical thinking.

Be aware that it is going to take a bold effort on your part to develop competencies in mathematics.

Like everything else, mathematics is learned best through practice and repetition. The are also a multitude of new concepts that you will have to sort out.

Whether your last course in mathematics was last semester or 25 years ago, this book is for you!

<u>This book is not a math book!</u> It is a book that describes the steps that you need to take to study and learn math successfully, no matter what you experience with the subject matter has been in the past. If followed, the items presented will boost your confidence level and make mathematical learning easier then you ever thought possible. You be the judge!

I expect an "A" in your next math course!

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Chapter 1

A BRIEF LOOK AT MATHEMATICAL HISTORICAL DEVELOPMENT

Before you begin a new course in mathematics, it will prove to be extremely useful if you were aware of its beginnings. Mathematics in the twentieth century is highly sophisticated in relation to what is was when many branches of mathematics were being developed over the centuries. Mathematics is an ever evolving science. The basic concepts still hold true but much has been added onto its foundation. Modern mathematics is truly exciting when one understands the vast number of disciplines that it is currently being applied to.

Mathematics today has widespread use in areas such as:

- business decision making
- medicine
- psychology
- biology
- physics
- economics

- real estate transactions
- investment decisions
- computer science
- government

It wasn't always applied to these areas as well as a host of others. It has however, become the foundation upon which many of the areas mentioned are built on.

In The Beginning...

The primitive notions of mathematics can be traced back to the earliest days of the human race. Mathematics is not strictly man's domain. Research has proven that mathematical principles are in fact exhibited by species other than man as well as that which can be seen in our environment.

In the Descent of Man(1871) by Darwin, it was noted that certain orders of higher animals possess certain abilities such as memory. As a result of modern research, it has been discovered that these same animal species can distinguish elements such as numbers and size. Experiments conducted by specialists in animal behavior have shown that species apparently have a kind of rudimentary perception of concrete quantities. This ability is not the same as the ability to count. However, it enables an animal to recognize the difference in size between two small collections of similar elements and changes, namely additions and deletions from that collection.

Consider a dog or cat that has puppies or kittens, respectively. You may have noted at some time, that if you were to remove one of the puppies or kittens, the animal would soon realize that the "set" of elements was not complete. This is a rather interesting concept. Just think what the mother would be thinking if you added a kitten to a litter of puppies!! Even though animals can realize changes to a set of elements, as was previously mentioned, they lack

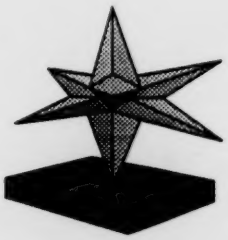
the ability to count. Counting is exclusively a human ability which is related to the development of intelligence.

The Need For Mathematics

If we were to venture to trace mathematics back to its origin, wouldn't it be logical to ask the following question?
Why was there an initial need for some form of counting or numbers?
It would seem that primeval man must have had a need to track the passage of time. In addition, primeval man must have noticed changes that occurred in the sky, in terms of the planets and stars. Possibly there was a need for some type of counting in order to record changes that took place in the sky. The concerns of primeval man were not the same as our concerns today. Mr. & Mrs. Primeval did not get up in the morning, have breakfast, send their kids off to cave school and leave for work in the wilderness! Although in the evening they might have gone out for dinner at the "Stone-Age Inn"!

Our early ancestors lived primarily by hunting and food gathering. One would assume, that even then, as the seasons changed, so did their hunting prospects and types of food that they were able to obtain. Would it therefore not make sense that they needed to somehow keep track of the changes of the seasons? What we have here is a cause and effect relationship. The cause related to our ancestors need for a counting method. The effect was the beginning of a counting method and the beginning of man's "romance" with mathematics!

Consider another interesting concept. Look around you and it is easy to note the patterns that nature displays.



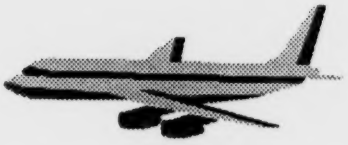
A snowflake, leaves, the roundness of the planets and the wave motion of the oceans. Significant work has been done in mathematics related to an attempt to convert a chaotic state into an orderly state. In business, many investors in the stock market have contended in the past that stock prices do in fact exhibit a certain order. In fact, they would make decisions on purchasing or selling stock based upon historical trends of a particular stock price. However, researchers have attempted to prove that stock prices exhibit what is known as a "random-walk" effect, meaning that historical trends are basically chaotic and random and provide no basis for future fluctuations. Again mathematics, has been playing an ever-increasing role in business, science and a host of other disciplines.

It has been within relatively recent times that man has had the opportunity to understand the types of numerical systems in use thousands of years ago. Early Egyptian inscriptions on tombs and monuments in Egypt, were a mystery to man for thousands of years.

As a result of a Napoleonic expedition in 1799, a great discovery was made...that of the Rosetta Stone. The Rosetta Stone was a tri-lingual stone tablet that contained a message in three scripts including the Egyptian Hieroglyphic. For the first time it enabled us to decipher hieroglyphics and uncover the basis of the early Egyptian numerical system.

In general, researchers find it rather difficult to speculate as to how far back in time man has used elements of mathematics to help him with situations that arose in his time. One could speculate based upon ancient artifacts that were found, cave paintings and educated guesses as to what ancient man's needs were, that the need to count, measure and construct, must surely have required some numeric thinking.

Today, mathematical techniques span a wide range of applications. Math affects each of us, each and every day. It is no longer a matter of choosing to avoid mathematics but rather essential that its basic concepts are understood for everyday living.



Chapter 2

A STRATEGY FOR SUCCESS

The intention of this book is to give you, the math student, a strategy for learning mathematics, effectively using all of the resources that are available to you. However, in order to use those resources wisely, you need to be aware of what they are. In addition, you also need to commit yourself to success. If you are taking a math course, or any course for that matter, I would assume that your intention is not to waste your time. If you plan on achieving the highest grade possible, then you need to develop a plan of action that will guide you through the course.

Your Commitment

Most people do not take a course in mathematics just for fun. Math is a rigorous subject with the potential for a heavy time commitment. You are aware of the reason that you are taking a math course. If you are a math major, then the answer is obvious. If your school requires it for completion of your academic program then you have a strong reason to successfully complete the course and get that portion of your academic career behind you. Whatever the reason, you need to define for yourself, why you are committed to succeed in math.

DON'T LET A MATH COURSE BE A STUMBLING BLOCK IN YOUR ACADEMIC CAREER!

Your Attitude Change

Too many of my students begin the course with a negative attitude. Are you one of them?
Do you keep telling yourself and those around you, that you have always had problems in math and you are sure that this course will be no different?

Have you been away from formal mathematics or the academic environment for so long that you wonder how you can possibly succeed?

Have you taken the same math course either once or twice before and either failed or dropped the course?

Do you simply have a dislike for mathematics?

Have you always found math to be an abstract subject area, and you do much better in courses that are more practical?

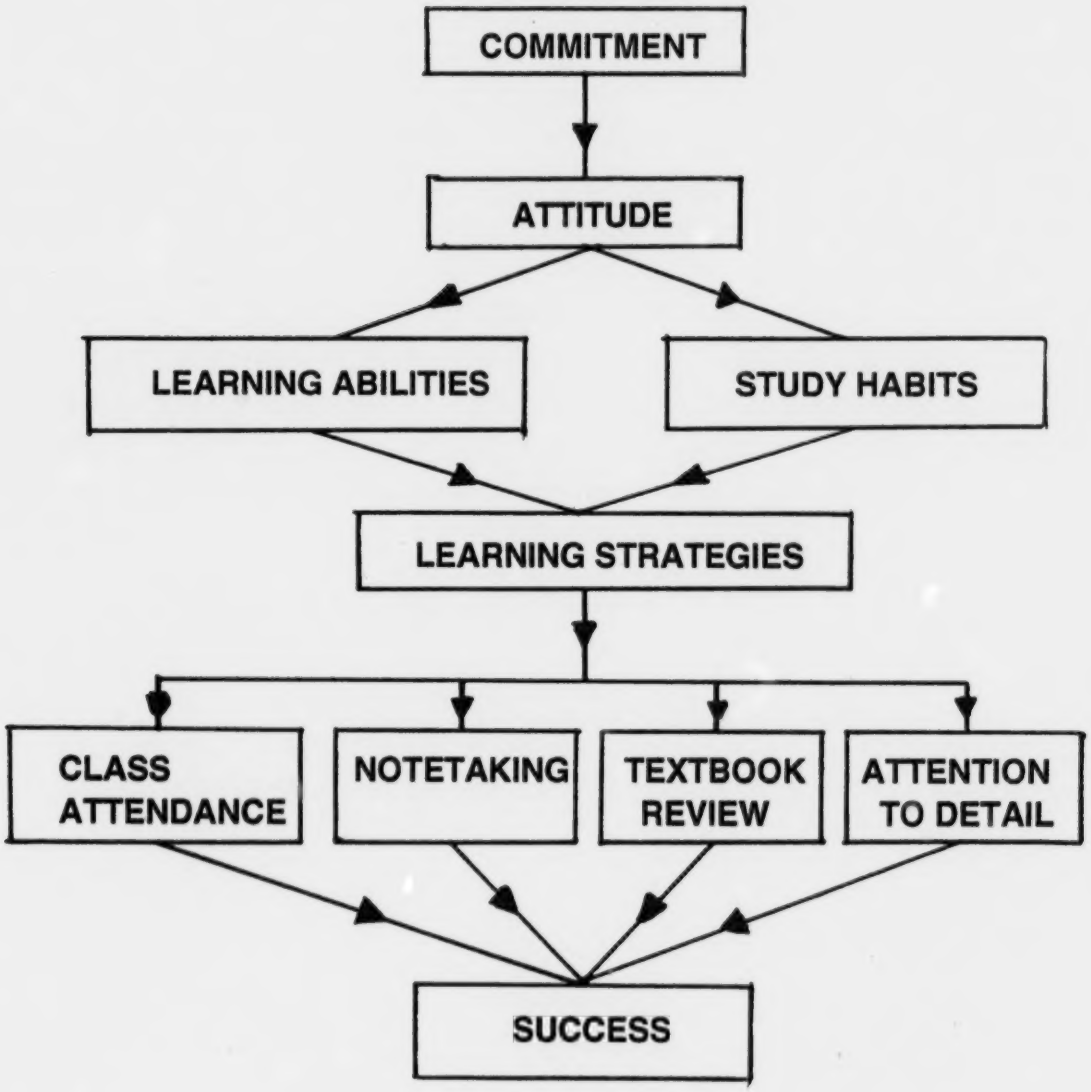
Developing Positive Thinking

By thinking these thoughts, you are establishing an obstacle to learning this subject. This is something that you want to avoid at all costs. With the help of the information in this book and your commitment that you will adjust your attitude and focus in on your potential for success, this math course may prove to be an enjoyable and rewarding experience. The outcome of this experience is a product of the effort that you put into it. There is no book, tutor, or instructor, that will assure your success if you have not established that personally. Your fate is in your hands. There is no alternative but to succeed. You have the tools and the ability to do it. Let success be your goal and discard any negative thoughts before you begin your course.

A Strategy For Success (Chart)

I have established a chart which allows you to view all of the elements that will ultimately bring you to your success goal. The chart indicates certain areas which are essential elements for success. You need to review these and consider how you are equipped to deal with each of them. You will see an item such as Study Habits. What kind of study habits do you have? Do you feel that your study sessions are productive? Another item relates to class attendance. Do you regularly attend your classes or do you have a habit of missing one too many classes? Let's look at the chart and its components.

A STRATEGY FOR SUCCESS



Elements Of Success

You will note that Commitment is at the top of the chart. Without that element, or your own understanding as to why this course is important to you and why you want to achieve success, the rest of the model is meaningless. Once you have established why this course is important for you to succeed in, any negative feelings toward mathematics as well as past unsuccessful experiences, need to be replaced with a very positive attitude. Based upon your ability to learn how to approach this course successfully, your attitude from this point on should be very positive! As noted from the chart, your positive attitude will allow you to implement the remainder of the elements leading to success.

In later chapters, you will find information on class attendance, note-taking, textbook review, study habits and an ongoing emphasis on attention to detail, especially in technical courses. Specifically, you will find that your attention to detail in math, will allow for its subtleties to become evident. Through good study habits and an ongoing and determined review of new material, you will gain the insight necessary to achieve well beyond your expectations!

Chapter 3

CHOOSING THE RIGHT MATH COURSE

ALGEBRA? GEOMETRY? CALCULUS?
TRIGONOMETRY? STATISTICS?

Which Course Is For You?

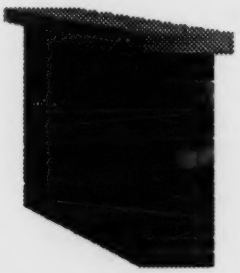
Numerous courses exist that one can take in mathematics. The course that is right for you depends upon your needs, prior mathematical background and type of degree that you intend to pursue. As was mentioned earlier, in order to achieve the status of a B.A. or B.S. degree, one or more courses in mathematics are required at most academic institutions. What course is right for you?

The Pre-requisites

Most colleges and universities have pre-requisites for taking any math course. They also have placement tests. A pre-requisite is a course that you had to have taken prior to taking an advanced course. It gives you the basic foundation that you need to have a good chance of successfully completing the next level course. Many institutions offer placement test to students. Often, these placement tests are intended only to give you an indication as to your mathematical strengths. It is then suggested to you what next course would be appropriate for your level of understanding.

Seriously consider the pre-requisite statement that is usually included under each course description in the course catalogue. The pre-requisites, just like the placement tests, are based upon research into specific course content and are critical elements when choosing the course that is right for you.

Math is difficult enough for most people, let alone trying to tackle this subject matter with an initial deficiency. It is really best to approach a math course slowly and in sequence. This allows you to become adjusted to the new terminology, techniques, and steps involved in mastering the subject matter. Mathematics courses, both as a whole and individually, are built upon the assumption that you acquire certain knowledge and use that knowledge to understand a new concept. You develop your understanding, piece by piece, just as a bricklayer must build a strong foundation by putting each brick in place correctly, until the house is complete.



It would probably not be possible but it would certainly prove to be a disaster, if you took calculus without ever having had algebra! Or if you took a course in statistics without having had algebra. Most statistics textbooks state in the beginning of the text that a basic course in algebra is suggested.

Required Courses

Often times, you will not have much of a choice in relation to the math course that you need to take. Most institutions have developed curriculums with certain required courses. It is not as though you might need to take a math course and it is your choice as to what to take. Most degree programs are fairly well structured. You may be required to take only one math course, such as college algebra, or depending upon your major, you may need to go through calculus.

Read the course catalogue of the school that you are attending.

- Note the math requirements of your degree program.
- Review the course offerings in the mathematics section of the catalogue.
- Consider the pre-requisites for the course that you feel that you need to take.
- Review the description of the course as stated in the catalogue.
- Are you familiar with any of the topics?
- Does it make you feel uneasy reading the description?
- Are there any required placement tests at your school that you need to take?

The final factors to be considered in choosing a math course are as follows:

- ***Your achievement on a placement test.***
- ***Whether or not you have the required pre-requisites.***
- ***The requirements of your degree program.***
- ***Your interest or non-interest in a particular course.***

REMEMBER!

You will have to live with the course that you choose to take. You will be spending lots of hours attending lectures, studying and completing homework assignments. If you don't want this endeavor to be a nightmare, choose your courses wisely! Make sure that you feel confident with basic concepts before you take on advanced material. In this way you will find mathematics to be enjoyable and extremely enlightening rather than a burden that will result in a poor grade.

Chapter 4

SELECTING AN INSTRUCTOR

YES, YOU DO HAVE A CHOICE!

You will often encounter the situation where, after having chosen the course that you want to take, you find that there are many sections offered. These sections may be taught by different instructors depending upon how large the math department is at your school. Be it known that each instructor has his or her own way of presenting the material. Consider the following list of items that could certainly be different when you are faced with a choice among different instructors.

- **Math jokes (very important to break-up the seriousness of the subject matter).**

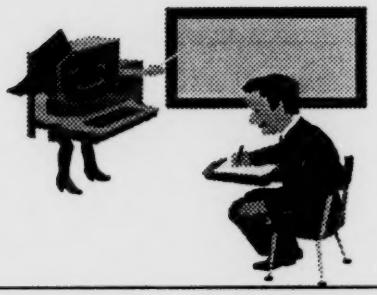
- Personal characteristics.
- Criteria for grading.
- Testing practices.
- Homework demands.
- Attendance demands.
- Ability to communicate effectively.
- Instructor's use of teaching tools such as sophisticated calculators, mathematical computer software, overhead projection systems for in-class presentations.
- Instructor's enthusiasm in teaching the subject matter.
- Instructor's response to in-class questions.
- What previous students have said about a particular instructor.

The thing that should come into your mind after reading this list of selection criteria is that you are actually "interviewing" an instructor.

IT IS YOUR RIGHT TO CHOOSE IF A CHOICE IS POSSIBLE!

Especially in math, a good instructor can make a ***BIG*** difference!

One would assume that if a college or university allows a particular individual to teach, either full or part-time, that person is qualified to do so. But what does qualified mean? In most cases, it means in the least that the individual is highly knowledgeable and holds advanced degrees in the subject area. It doesn't always mean that the individual can communicate the subject material effectively to the students. It doesn't always mean that the individual is a "joy" to listen to during a one or more hour lecture!



REMEMBER! YOU ARE A CAPTIVE AUDIENCE!

The longer you attend a class, the more captive you become. Most schools, for a specified time period, offer you an option to drop a course if that is what you choose.

However, you might be able to drop a course if you find that either the material or the instructor is not to your liking but you can't readily switch into the same course with a different instructor in the middle of the term. Essentially, you are stuck with an instructor for the duration of the semester. If you drop the course, you essentially have wasted your time. Of course there are other personal reasons that may require you to drop a course, but allow me the "academic freedom" of constraining this scenario to only the instructor.

If you can work it into your busy schedule, it would be a good idea to sit in on an instructor's lecture. You might do this during the semester or quarter prior to considering that instructor for the course. You will see for yourself what that instructor's style is. How is the class responding?

Will you be able to learn from this person?

REMEMBER: **THE INSTRUCTOR THAT YOU CHOOSE FOR A COURSE, IS GOING TO HAVE AN IMPACT ON YOUR CAREER OR OBJECTIVES. A "D" FROM ONE INSTRUCTOR, MIGHT HAVE BEEN A "C" OR EVEN A "B" FROM A DIFFERENT INSTRUCTOR!**

It might also help if you could obtain some feedback from past students as to a particular instructor's tests. Are they considered overly difficult? Do others consider them fair? Is the instructor looking to make mathematicians out of each student, regardless of their commitment to mathematics or their career and degree objectives? After doing your own "personal" homework, the choice then becomes yours.

Be it known that modern technology has blessed academics with many new and fascinating teaching tools. Especially in math and science areas the teaching tools such as calculators, computers and in-class projection systems, are extremely valuable in making the subject matter much more interesting to the average student. Mathematical videos, math audio tapes, user friendly computers with built-in math testing and tutoring programs, are just some of the current innovations.

LEARNING MATHEMATICS NO LONGER HAS TO MEAN SIMPLY ATTENDING LECTURES, DOING COUNTLESS EXERCISES AND TAKING TESTS! THE TEACHING OF MATHEMATICS HAS CHANGED! MAKE SURE THAT THE INSTRUCTOR THAT YOU CHOOSE HAS CHANGED WITH THE TIMES! OTHERWISE, YOU WILL BE FACED WITH LEARNING A DYNAMIC AND MODERN SUBJECT WITH "STONE-AGE" PRESENTATION METHODS!

Several times at the beginning of a semester, students have called me asking to be allowed to transfer into my class and out of the class that they had enrolled in. Most of these students did not even know me but did know after only one or two lectures with their current instructor, that they needed to get out fast!

The statement that proved to be the "common denominator" was, "I just won't be able to learn from this instructor!" Don't trap yourself in that situation!

GETTING AN EDUCATION IS WHAT YOU ARE GOING TO SCHOOL FOR. YOU ARE NOT GOING TO SCHOOL TO BE THREATENED BY AN OVERLY EXCESSIVE WORKLOAD, ANTIQUATED OR RIGIDLY STRUCTURED GRADING SYSTEMS OR DE-MOTIVATING AND BORING LECTURES.

Dealing With An Instructor's Teaching Style

Once you have established yourself in a class, it is a kind of wait-and-see situation in relation to what your instructor will be like. Based upon student comments concerning other instructors and sometimes even myself, it seems worthwhile to discuss these concerns and possible remedies.

Each instructor has their own teaching style. Their teaching style relates to the way in which they administer the following course elements:

1. **Exams**
2. **Homework Assignments**
3. **Response to questions in class**
4. **Instructor Office Hours**
5. **Pace of their lecture**
6. **Writing on the board**
7. **Instructor's lecture presentation style (walks around, stares at board)**
7. **Grading system**
8. **Personal problems with the instructor**
9. **Instructor assumptions during lecture**

Instructor Exams

Even though I have mentioned this before, it is worth emphasizing. When exam time comes, make sure that you question your instructor as to exactly what will be contained on the exam. Make a list of the topics. Students often consider an exam to be unfair or extremely difficult in view of what the

instructor had stated would be on the exam. There is not much that you can do about this problem with the exception of preparing yourself for the worst!

In addition to developing your list of topics that the instructor indicates will be covered on the exam, you can also prepare by the way in which you do your practice problem solving. Don't only do the easy problems. Work on the more difficult problems when you are studying for the exam. Your textbook should contain a variety of problems. Your preparation in solving as many problems as you can, at different difficulty levels, will better prepare you for surprises on the exam.

If you are still convinced that the exam was unfair or overly difficult, speak to your instructor about it. Show the instructor your list of topics that you used as a guide for studying and why you feel that the exam either covered topics not on your list or presented those topics in a more difficult manner then you were expecting. There are no guarantees that your instructor will be convinced, but it is worth a try!

Remember, the degree in which you prepare for the test is your best defense against the potential of a difficult exam.

Homework Assignments

Some instructors assign a large quantity of problems to be completed by the students. Usually these will be indicated on a handout, which will contain the assignments for each chapter in your textbook. However, other instructors will assign very few problems.

You really need not be concerned with the number of questions that your instructor assigns. You should, as part of your studying, be doing more problems then the instructor assigns. If the instructor assigns 10 problems, there is no reason why you should not do 15 or 20 problems. Do as many as it

takes until you master the topic. If your instructor assigns relatively easy problems, take it upon yourself to try the more difficult problems. In this way you will be prepared for surprises on the exam and gain a better understanding of the material.

There is certainly no lack of problems in mathematics. You can always use alternative textbooks for additional problems or review texts which tend to concentrate on problems solving. Your efforts in the problem solving area will be rewarded when exams approach. You will be better prepared and more likely to score high on the exam.

Response To Questions In Class

Your instructor will usually tell you his or her policy with regard to asking questions. Some instructors will ask for questions on an ongoing basis. Other instructors will never ask for questions during lecture. Don't wait for your instructors prompting. If a question arises, ASK! If your instructor is in the middle of a thought process, hold your question until the instructor finishes. Instructors should welcome questions. One student's question may be on the minds of many students. Some instructors, for their own unknown reasons, are not responsive to any questions in class. If you encounter this, you might want to speak with that instructor concerning his or her policy and how it affects your learning. The instructor is there to communicate information to you and assist you in your learning. Questions are an important part of the learning process and should always be addressed.

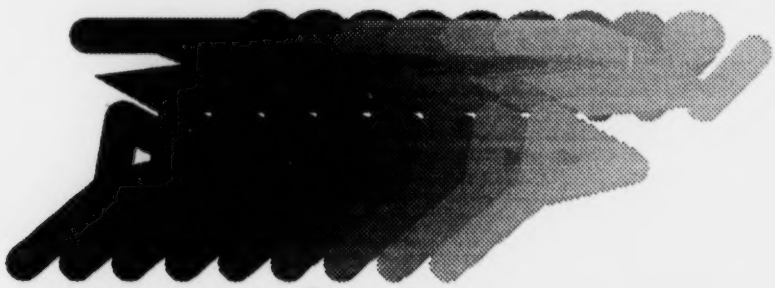
If you feel that your instructor's response to your question in class was insufficient or you didn't understand it, don't be afraid to ask the instructor to clarify his or her response. A question relating to a difficult topic may take numerous attempts at an explanation. If you must, ask your instructor the same question twice until you feel confident that you understand the answer.

Instructor Office Hours

If your instructor has office hours or times at which he or she will be available for consultation, those should be made clear to you at the start of the course. You might want to get your instructors mailbox number, in the event that you need to send him or her a note regarding a problem that you are having or to set up a time to meet. If your instructor makes himself or herself available to you, then make use of that availability. Establish specific questions in advance so that your time is spent effectively.

Pace Of The Lecture

Many students, especially those that have problems learning math, become very concerned with the pace of the lecture. Some instructors seem like they are racing through the material without regard for student comprehension.



You can always attempt to slow the lecture down by simply raising your hand and asking the instructor to slow down. If the instructor cares about the students learning the material, he or she will get the message and slow down. Otherwise, you might try breaking the place of the lecture by asking a question. If an instructor is "tuned into" the class, he or she will know when the class seems nervous or overly anxious as a result of the material being presented. It was always obvious to me, standing in front of the classroom, when the students were annoyed at something. I would stop and ask what the problem was. However, some instructors get carried away with their thought

processes. It is then up to you to indicate your concern with the pace of the lecture.

Making a friend in the class who you know takes good notes, is always a good way to backup your note-taking. If you miss some of the points, as a result of the lecturer's pace, then you might be able to fill in your notes from your friends notes.

If allowed, you might want to bring a cassette recorder to class and tape the lecture. Taping is not a substitute for note-taking but if the instructor continues to lecture at a faster rate then is comfortable for you, a recorder may be helpful.

Inquire from other students if they also feel that the instructor is going too fast. If there is a consensus on the matter, you might as a class, send the instructor a note stating the class's concern. Again, some instructor's are habitually fast paced. If you are stuck with one like that, you may just have to deal with it. However, you do have remedies as already mentioned. Use them!

Writing On The Board

Did you ever look at a prescription for medicine written by a doctor? Were you able to read it? Did you ever wonder how the pharmacist understands what is written and doesn't make a mistake with your prescription? It seems that they don't offer any penmanship courses in medical school!

Part of an instructor's ability to communicate with the class is based upon his or her ability to write clearly on the board. From the instructor's standpoint, they are doing multiple tasks at the same time. They are writing, thinking and talking at the same time. Often, their writing suffers. That directly affects the student's ability to take notes. Some instructor's write very detailed and clearly while other seem to scribble on the board and write in every available space. Sometimes, one part of an equation is in one spot while the rest of the equation is somewhere else. If you look away from the board for an instant,

you might lose sight of where a statement, theorem, or equation started and ends!

Again, you can always ask the instructor for clarification if you are confused by what you see on the board. I have had students come up after the class to ask me questions regarding things that I wrote on the board. They then filled in their notes. Understand, that college instructors, including those with Ph.D's, are not required to have taken a course in effective communication and lecture skills. Each instructor has their own methods. I have not as yet met an instructor who is perfect in every aspect of his or her teaching skills.

If you continue to find that the instructor's board work causes you problems, it could relate to your position in the class. Possibly you need to be closer to the front of the class so that you can see better. Instructors understand that you are trying to take notes and listen to the lecture at the same time. The majority will make an attempt to minimize your problems deciphering their boardwork or they will answer your questions and clarify a word or equation that you find difficult to read.

Instructor's Lecture Presentation Style

Each instructor has their own presentation style. Consider the following styles that you might encounter.

1. The instructor stands in the same place for the entire lecture.
2. The instructor paces back and forth across the room.
3. The instructor often walks around the room.
4. The instructor is always staring at the board and never looks at the students.
5. The instructor mumbles.
6. The instructor's foreign accent interfere with your ability to understand what he or she is saying.

Instructor Stands In The Same Place

When an instructor uses an overhead projector in place of the blackboard, that instructor could stand in the same place throughout the lecture. There is no need to be running all over the front of the room writing on the blackboard. You would be staring at the projection screen as the instructor writes. The use of the overhead projector may in fact make the instructor's writing neater but when the transparency is removed, so to are the lecture notes. You may have to ask at the end of the lecture to see the transparency that you were unable to finish copying.

In my opinion, an instructor who stands in the same place throughout the lecture can be quite boring.

Having taught adult, evening students, one of my concerns is to keep them awake! Moving around the room, either writing on the board or talking, seems to increase the student's attention span. However, you may just have to deal with whatever the instructor's practice is.

Instructor Paces Back And Forth

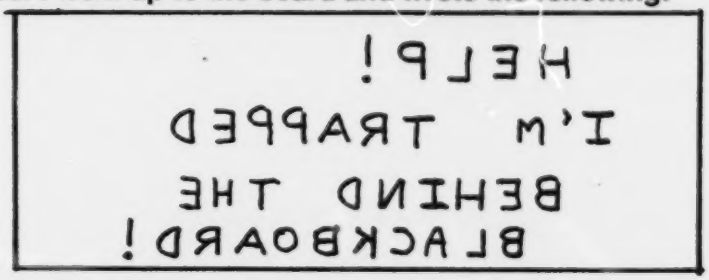
Some instructor's have a tendency to pace back and forth across the room as they lecture. Keep your eye on the instructor because you never know when he or she will suddenly stop and write something on the board and then be gone in a flash. Be attentive in class and accommodate the instructors style.

Instructor Walks Around The Room

Don't get all upset if the instructor walks right next to you during a lecture. Many instructors walk right into their audience. It has the effect of making a rather impersonal lecture a little more personal. Don't worry, the instructor is probably not going to attack you or ask you to define the derivation of an equation. However, if the instructor is close-by and you suddenly get the urge to ask a question, he or she can't miss your hand being raised!

The Instructor Is Always Staring At The Board And Never Looks At The Students.

Yes there are instructors like that. You have to shout out that you have a question since they rarely look at the class. I had an instructor who would come into the lecture hall and pace the floor back and forth for at least two minutes before beginning. When he finally began he would never look at the class, but would just stare at the board and write. I became very disturbed with this since it seemed that he was oblivious to the students listening. It seemed that he was lecturing to a class that was positioned behind the board! One day I actually came in 15 minutes early, before any of the other students had arrived. I went up to the board and wrote the following:



Upon the instructor's arrival, he again began pacing the floor in front of the blackboard. After his fifth pass in front of the blackboard he glanced at what I had written. He then continued with his pacing and, believe it or not, when he came back near what I had written, it was distinctly visible that he glanced behind the edge of the blackboard. (I present this very well in person).For some reason he thereafter began to look at the class. Well, it was a drastic attempt on my part to correct his presentation style. It seemed to have

worked! I wouldn't advise that you try this but look out for those types of instructors!

The Instructor Mumbles

Oh No! Not the case of the mumbling instructor! Yes some instructors mumble. Obviously that makes it most difficult for the class to understand what that instructor is saying. If this occurs, politely ask the instructor to speak up. Otherwise it may be advisable to get a seat as close to the front of the room as possible. A mumbling instructor is not necessarily trying to hide his or her math deficiencies. Again, every instructor is not skilled in public speaking!

An Instructor's Foreign Accent

A countless number of times I have been told by students that they had problems in another math class because the instructor had a heavy foreign accent or did not have perfect English speaking skills. Unfortunately this is often the case. And it can have an effect on your learning. If you have difficulty understanding the instructor, ask him or her to speak more slowly or to repeat a statement. It would be best if this instructor didn't say anything and just wrote everything, hopefully in good English!

Even though math is considered a "universal language", the students cannot be expected to understand a universal set of languages. If the problem is having an effect on the entire class, it may be advisable to bring it to the attention of the Chairperson of the department. Hopefully, the Chairperson and your instructor are not the same individual!

Grading System

In relation to the grading system, all that I can say is make sure that you know how the instructor will grade your work in the course. Usually, this information is presented on the course outline as will be explained later. Each instructor

has their own grading system. Make sure that you understand it. Understand the point value for each test, homework assignments, projects, and class attendance. The burden is on you. Don't go back to the instructor at the end of the term asking way you received a B grade when you got all A's on your exams but didn't turn in any of the homeworks. The instructor might just inform you the homeworks submission was worth 15% of your final grade!

Personal Problems With The Instructor

Personal problems that develop between you and the instructor should in no way impact your success in the course. Deal with whatever difficulties that you may encounter by bringing them to the attention of the instructor or just by ignoring them unless they are serious enough to bring to the attention of an administrator.

Instructor Assumptions During Lecture

You will often find that your textbook may make an assumption that you know how an equation progresses from one form to another. The author may leave out an interim step. This is an assumption made on the part of the author. It is assumed that you are aware of what was done in the transition.

Your instructor may make assumptions also, based upon his or her feelings as to what you already know. If this occurs, and something becomes unclear, ask the instructor to fill in the missing pieces. If this problem occurs in your notes when you are reviewing them, make a note to ask your instructor at the next class meeting. In the course of a lecture, it is sometimes difficult from the instructor's standpoint, to fill in all of the details. Since you will find that mathematics is built on your understanding of previous topics, it is your responsibility to understand each topic well enough so that you can use the information in more advanced topics.

You can always ask another student how a specific equation or statement was arrived at if your instructor left out a transitional step. Clearing up your confusion is critical to your understanding of the remainder of the lecture.

Applying Math To Everyday Living

As a final note in this area, it might be a good idea to consider how the instructor integrates theory and book knowledge with practical applications. There must be a reason why I am being confronted by an increasing number of my students who are asking the same question, "But Professor, how is this going to affect my personal and professional life?" You as a student have the right to demand that your education be based in part on practical knowledge. If you intend to use your degree as a key into a professional career, then you should be aware of how the material that you are learning can and is being used outside of the ivy covered walls.

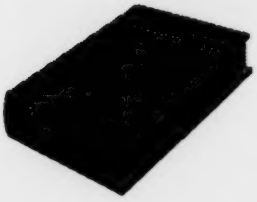
ACADEMICS IS CHANGING BECAUSE THE DEMANDS PLACED UPON ACADEMICS ARE CHANGING!

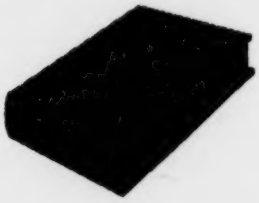
Extra effort made on the part of instructor's to interject "real-world" applications into their teachings, should no longer be an added bonus...it should be a requirement!

Yes, you do have alot of things to consider in "choosing" an instructor. But just think how much easier this semester will be if you choose correctly!

Chapter 5

THE TEXTBOOK PURCHASE





There is usually not much choice in the selection of a textbook for a particular math course. The instructor decides what textbook they want to use along with either a suggested or required student study guide or workbook. You need to know that textbook authors and publishers are currently producing a wide variety of supplementary material which accompany the standard textbook. This is a result of advances in technologies which allows for the production of such things as:

- **Video tapes**
- **Cassette tapes**
- **Computer software**

These items may not be available directly to you but are often available to the instructor, upon adoption of the textbook. Make use of these new technologies by asking your instructor if he or she can make them available to you. All three items can be extremely helpful to you with your studies. Many courses are currently structured using nothing but video tapes. No instructor!!

Many instructors are now choosing to use their own materials such as a compiled book of notes, a desktop publication which the instructor personally produced, or sometimes no text at all. If a standard textbook has been authorized for use in the class, your campus bookstore should carry that book

for you to purchase. If your instructor has chosen an alternative option, then he or she will inform you of it at the first class meeting.

Obtaining The Textbook Early

If you feel certain that you will be admitted into the course, I would suggest that you purchase the textbook early. Don't wait for the day before the first class session to purchase the book. Depending upon the constraints set down by the bookstore in relation to their hours of operation and availability of books, try to purchase the book at least a week prior to the first class session. Open it! It won't bite you!

A Preliminary Textbook Review

Look through the table of contents. Review the highlights of each chapter. Read the "Preface". Determine if the author states any skills requirements before attempting to understand the material in the book. Have you filled those requirements? Review the chapters of the textbook. Are any chapters missing? (Just kidding!) In the few days that you have, concentrate on reviewing in some detail at least the first chapter.

Spend some additional time on reviewing what you consider to be the complex components of that chapter, if any. Why am I telling you this? Because you will then have an "edge" over other students who choose not to do this? You will be coming into the first class meeting "informed"! Remember, the first class meeting is usually quite hectic especially if the class if large.

Your instructor will be telling you many things about the way that the course will be administered. You will have to concentrate on and consider all of the information that is being thrust upon you. Immediately following any introductory remarks and administrative narrative, you will be confronted with the pure subject matter. Guess what? You are already fairly familiar with what the beginning subject matter is all about, since you reviewed in some detail the first chapter of the textbook. Your instructor is now really reinforcing and adding to what you already know. ONE LESS THING FOR YOU TO WORRY ABOUT! It would be a good idea to get into the habit of reviewing material in your textbook that you know will be presented in the lecture, prior to attending that lecture.

THERE WILL BE PLENTY OF OPPORTUNITY FOR YOU TO GET NERVOUS ABOUT YOUR MATH COURSE. DON'T GET NERVOUS ON DAY ONE!!

By doing your "homework" in reviewing the textbook, prior to your instructor's suggestion, you will be in a much better position to "ease into" the subject matter and not be totally overwhelmed at the start.

QUESTION: **WHAT KIND OF A STUDENT DOES IT TAKE TO OPEN UP A MATH TEXTBOOK PRIOR TO BEING TOLD TO DO SO?**

ANSWER: **A STUDENT WHO IS DETERMINED TO SUCCEED!**

When I say that you are reviewing the material prior to the first class meeting, I mean exactly that. You are reviewing the material in the early sections of your textbook, at your leisure and not at your instructor's demands! By doing this you will set yourself up for a more evenly paced semester and develop early on, a personal method to the madness of studying mathematics.

JUST THINK, YOU MIGHT EVEN HAVE QUESTIONS FOR THE INSTRUCTOR DURING THE FIRST LECTURE. THAT WOULD CERTAINLY AMAZE YOU!

I personally viewed the purchase of textbooks to be one of the highlights of each semester. I did not view the books that I purchased, yes even math textbooks, as intimidating because of their size or weight. I viewed them as a source of new knowledge that I was eager to learn.

Books represents a documented source of human achievement and knowledge. You are now realizing that knowledge through your studies. How you approach acquiring that knowledge and using it, is up to you. However, there it sits before you, staring at you, eager to traverse the boundary from book to brain. Eager to give you the basis upon which you can utilize it for your own purposes and hopefully even expand on it in new ways.

The textbook purchase...Certainly a first step in expanding your mental boundaries!

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Chapter 6

READING YOUR MATH TEXTBOOK

Reading Technical Material

We all will admit that reading a math textbook is quite different than reading any other type of book.

A novel can be read fairly quickly, with good comprehension. If you have studied speed reading, you might be able to finish a 300 page novel in an hour!
However, a math textbook is not a novel. Technical texts, such as textbooks in economics, physics, chemistry, medical texts and biology, take a significant amount of time to read each page. In a math textbook, you might spend 45 minutes just studying one page! That is to say if you can stay awake for 45 minutes!

Reading a book that contains technical information requires a different procedure than if you were reading a non-technical text. How are you going to best understand what you are reading? Let's consider the following idea as a way to maximize your understanding of each page and make the most efficient use of your study time. Remember, this is not your idea, but mine. I take full responsibility for giving you this burden. However, if you want to be successful in learning mathematics, you need to develop a learning strategy.

Taking Notes From Your Textbook

As you read a section of your math textbook, have available a pencil and notepad. Better yet, you might want to get yourself some index cards for use instead of the notepad. As you read a page, note on the index cards the important points that are discussed. Write down any equations, formulas, and even a problem, complete with its solution, that best represents that which is being discussed. You will find that on a single page of your textbook, many different points may be mentioned that relate to learning a specific technique or solving a given set of problems. You will also find new terminology. Now you can see why reading a page can take you 45 minutes!

I am not an advocate of destroying your textbook for the next student purchaser, by you permanently highlighting points that you consider important. In addition, marking up the book in other ways with question marks, comments, etc., will prove less useful then if you re-write those important points on separate cards. Unless you plan to keep your book, limit your re-writing, comments and questions, to the index cards.

When you complete a page, you will then have written on index cards the major points that were discussed. You might have a number of cards for each page. The simple act of writing these points down, will enhance your learning of the subject. At some future time, instead of opening that textbook again, an event which most of us want to minimize, you can simply review what you have written on the index cards.

Just think, the index cards are much more easily transported then your textbook. Index cards like to go to weekend parties and lunch or dinner at your favorite restaurant! Index cards welcome the opportunity to leave your house!

If you are at a party or social gathering during the weekend and things get rather dull, pull out some of your index cards and review the material. You might even discuss it with some of the other people in attendance!

Who knows what kind of people you might attract!

While you are eating lunch or dinner is a good time to review the cards. You will surprise yourself at how rapidly you will remember and understand the concepts and terminology.

No, I am not asking you to re-write the textbook, I am asking you to reinforce your personal study habits. I am asking you to reinforce your knowledge base on a daily basis by reviewing the cards instead of carrying your textbook around. If you recall, your objective is to successfully complete your math course. Whether or not you feel capable of it, my intent is that you receive an "A" grade in your course. No matter what your track record has been in past math courses, it is highly possible to achieve that which you may think impossible! This achievement requires both a change in your attitude and a change in the way you approach your course.

Textbook Format

There is no doubt that some textbooks are easier to read than others. Let's consider an algebra textbook as the first example. Of all of the algebra textbooks that I have seen, they generally follow the same format. Each chapter begins by discussing new terms and then shows specific examples that relate to the new topic. The number and diversity of the examples presented, assist the reader in solving a wide range of problems, each differing in a certain way. Some books however, show very few solved problems, while others show many solved problems. For a student who has

difficulty in math, a textbook that presents more detailed explanations, and more solved problems, will certainly be beneficial. Again, if you consider the textbook that is assigned by your instructor, to be difficult and confusing, there are an abundance of other textbooks that you can review, especially in algebra.

In higher level courses, such as statistics, finite mathematics and calculus, the same holds true. As you read each page, write down the key points, equations, problem solutions, but be aware that there are alternative sources that you can review if the material becomes confusing.

Through the information presented in this chapter and the strategy of taking notes directly from your textbook for later review and learning reinforcement, you now have a means through which you can significantly increase your comprehension. This, coupled with your regular class attendance, completion of assignments, questions asked in class, general study habits and your positive attitude toward learning, will get you through any mathematics course with grades far in excess of that which you ever thought possible!

Chapter 7

USING AN ALTERNATIVE TEXTBOOK

TEXTBOOKS ARE WRITTEN FOR THE MASSES! YOU ARE AN INDIVIDUAL!

Textbook Frustration

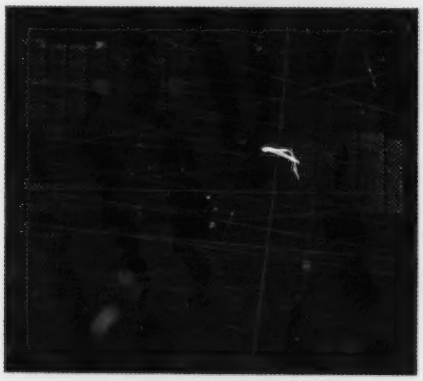
Don't be surprised if you are unhappy with the assigned textbook for your math course. Many students feel the same way. If the instructor uses a textbook, he or she will use a book that they may have written, reviewed or just one that they feel comfortable with. That does not mean that you will feel comfortable with it. Your instructor will use the textbook for homework assignments and as a general guide for the lecture material. Your use of the textbook serves to reinforce class lectures. Following the lecture on a particular topic, you can review your lecture notes and review the topic in the textbook. Most textbooks seem to be notorious for a deficiency of actual solved problems. In addition, problems at the end of each section may be different from those already solved in the text. The result can be frustrating!

SUGGESTED SOLUTION:

Just because your instructor requires a specific textbook, does not mean that you can't use other textbooks. Be it known that in any math course that you might take, there are several published textbooks. Each book, being written by a different author, takes a different approach to the subject matter. Some books are easy to read because the author makes an effort to give additional detail and additional solved problems. Other texts are more difficult to understand because the author may make certain assumptions that you are aware of certain concepts. I don't make that assumption! Why leave things out and make the student wonder how the author got from one point to the next? Since mathematics involves the learning of specific techniques, the more solved problems to reinforce the techniques learned, the better.

If you are having trouble with the textbook, see if you can acquire another textbook that you may feel more comfortable with. You local library will probably have many to choose from so you don't have to buy one. In addition, there are outline texts available at local bookstores or from college bookstores which can be very helpful. These outline texts have many solved problems and often give an alternative approach to many of the topics that you are having problems understanding from your textbook. Using two alternative textbooks to complement your required text is not unusual. You will become aware of different approaches to the same subject matter.

DON'T LET THE REQUIREMENT OF A SINGLE TEXTBOOK BE AN OBSTACLE TO YOUR LEARNING THE SUBJECT MATTER!



In mathematics, utilize all of the resources that are available to you. Two people can say the same thing but only one might be understood! You want to find the one that you can understand. Certainly, the acquisition of additional texts will require some effort and desire on your part. However, if you use this approach you may find that your understanding of many concepts will significantly improve. Often times, other textbooks will give you insight into how to solve assigned homework problems that you required text does not present.

Take advantage of that which is available to you. Don't let anyone tell you that there are any restrictions placed on learning.

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YOU WILL LEARN BEST FROM THE SOURCES THAT YOU CAN UNDERSTAND!

Chapter 8

ATTENDING THE FIRST CLASS

In any course that you take, but especially in mathematics, your attendance at the first class meeting is critical. It is probably one of the most important sessions that you will attend.

In the first class meeting the following items relevant to the course will most probably be discussed by the instructor. Listen Up!

1. Distribution of the course outline.

Most instructors will have prepared a course outline so that you as the student will see the proposed course discussion topics, grading system, attendance requirements, required textbooks, required additional readings, term papers, examination schedule, projects, and computer lab requirements, if any.

The course outline...Don't Leave Class Without It!

The instructor will usually go over the course outline at the first class meeting. If something isn't clear, make sure that you ask the instructor. The outline will give you the guidelines that you need to structure your semester. Use the outline to pace yourself during the semester, being aware of dates of discussion topics so that you might prepare in advance. Also, note proposed exam dates so that they won't come as a surprise.
If a course outline is available and it should be, the instructor is giving you information about the course in advance. Use it to your advantage!

2. General Discussion Of The Course.

Each instructor approaches the first class meeting differently. Some will give you a general overview of the course, discuss each item on the course outline, and present some introductory remarks about how best to approach the subject matter. Others will minimize their remarks and get right into the first discussion topic. Whatever their particular practice, the first class session will give you a feel for the way that the instructor will conduct the course. It will give you insight into their particular style. Does the instructor have a sense of humor or is he or she very serious? Do you feel that they will be able to communicate the information to you? Does the instructor make you nervous or do you feel that they may in fact make math enjoyable?

Most instructors will not repeat many of the remarks that they make during the first class session. It is really important that you listen and understand what you have gotten yourself into! After the first class meeting it is often not too late to change instructors and transfer into another class section, if available. You can get class notes from another student if you have to miss a lecture but only being there in person for the first class will allow you to experience for yourself the course objectives and instructor characteristics.

3. The Grading System.

Each instructor has his or her own grading system. Some instructors will use letter grades while others will use a sophisticated numeric grading system. At the first class meeting, your instructor will indicate the type of grading system in use. If their grading system is based on a point system, then be aware of what you have to achieve to get that "A". Be aware of how many exams are planned and what percent of your grade is associated with each exam. Are there opportunities for extra credit? Are there term projects, papers, or lab assignments that will contribute to your grade? If so, how much are these worth?

The type of grading system that the instructor will use is directly related to your success in the course. A "B" student with one instructor could have been an "A" student with another instructor. It all depends on the elements that compose the final grade and the way that the instructor computes both exam and final grades. Clarify any questions that you may have in relation to the grading system, at the first class meeting.

Concern yourself with understanding the course material but be aware of how your untold hours of study are going to be rewarded.

4. Attendance Requirements.

Be sure to find out at the first class session what requirements the instructor has for class attendance. Many colleges and universities require the instructor to take attendance at each class meeting. If you miss your name being called, the instructor may mark you absent for that day, even if you arrive late. Instructors will "drop" students from the class when they have no record of their attendance or their attendance is sporadic. Don't let this happen to you if you have every intention of remaining in the class. Your instructor will mention his or her position on class attendance, coming late to class, missing exams, etc. Make sure that you understand these requirements, your status in the class will depend on it! If you plan to be absent, make sure that you know where your instructor's mailbox is or his or her office phone number.

You as a student are only a name and ID # in your instructor's grade book, if that is what you want to be. If you take an active role in the class and make the instructor aware that you care, then the instructor will care when final grade time comes!

5. Homework Assignments.

At the first class session, a homework assignment listing will usually be distributed. Understand what is required in relation to the homework. Does your instructor require that you submit it? Are homeworks graded? Is there a particular format required for submitting the homeworks? Are there specific due dates for each assignment? Your instructor will define the policy on homeworks, papers, lab assignments, etc., at the first session.

DON'T LOSE POINTS, ESPECIALLY IN MATHEMATICS, ON A TECHNICALITY RELATING TO AN INSTRUCTOR'S POLICIES. KNOW WHAT IS REQUIRED. BE PREPARED! CONCENTRATE ON LEARNING MATH WHILE BEING AWARE OF YOUR INSTRUCTOR'S REQUIREMENTS.

Chapter 9

ATTENDING LECTURES

What To Expect

Whatever your instructor's requirements are in relation to your attendance at lectures, plan on attending. There is nothing more boring then learning math from a math textbook. If your instructor is what I call a "state-of-the-art" instructor, then that will add a new dimension to your study of mathematics. By definition, a "state-of-the-art" instructor has certain qualities:

Instructor Qualities

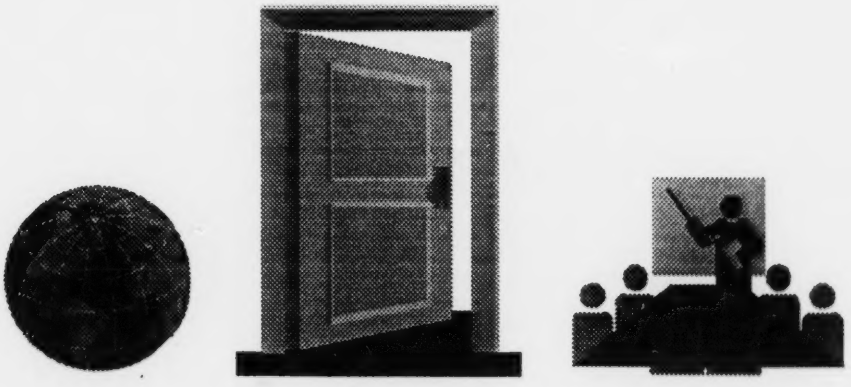
- **Brings math to life.**
- **Motivates you to learn the subject matter.**
- **Allows you to "discover" mathematics.**
- **Reinforces, enhances and strongly supplements that which is in your textbook.**
- **Uses modern teaching tools such as calculators, computers, and hands-on, in-class projects, to make math exciting.**
- **Presents students with "real-world" problem applications.**
- **Has as an objective, that students finish the course with specific mathematical tools that they can apply in their careers.**
- **Understands that the average student does not want to become a mathematician!**

As you can see, there is much more to mathematics then that which is evident in your textbook.

If you have chosen correctly, it is your instructor who will make your math course enjoyable and enlightening, not your textbook!

Benefits Of Attending Lectures

You will benefit from your instructor's expertise by attending lectures. It is a time when you will also be able to interact with your classmates. You will hear first hand what difficulties other students are having. Unless the instructor has other intentions, the classroom is a learning environment and not an environment for you to feel threatened and lose sight of why you are studying this subject. The lectures offer an environment for interactive discussion, directed and prompted by your instructor. Be a part of it! Try to come to class ready to learn mathematics. When you cross the threshold of your math class, leave your personal, family and other "worldly" matters and problems outside. BE ATTENTIVE! THINK MATH!



Lecture Strategies

Depending upon the school that you are attending, your class may have as few as 10 students or as many as 50 or more. Whatever the size of the class, when you are sitting in your seat, assume that the instructor is talking directly to you. Listen as though you personally will be asked to respond to a

question. If you think this way, your attention span will increase and you will be less likely to miss key points.

It is a good idea to acquaint yourself with one or two of your fellow students. You can accomplish this either at the first class meeting or at subsequent class sessions. Developing a friendship with these students will allow for an exchange of phone numbers in the event that you must miss a class session and need to determine what went on. In addition, it will provide a good resource for obtaining class notes if you should miss a session.

Another reason, which I will mention in an upcoming section, is to allow for the possibility of organizing a study group.

Instructors will often make changes to their intended course schedule, during the term. During the lecture, the instructor may present material or an alternative method of solving a particular problem, which is not in the textbook. If you miss a lecture, you may miss important points that will appear on your next examination.

Coming To Class Early

Try to get to your scheduled lecture 10 or 15 minutes early. This will allow you time to get settled and, I know this is difficult, into the mood of learning mathematics. When you come to class, you are obviously coming from somewhere else. You don't live in your math class. You may be coming from another class, from work, home, or lunch. Wherever you have been, your mind has been on something else. You need time for your mind to adjust and settle down to its full concentration on math. In addition, in the extra 10 or 15 minutes that you have before the lecture begins, review your notes from the last lecture and think of any questions that you want to ask the instructor. I have found that the students who come to lecture 5 or 10 minutes late, need an additional 5 or 10 minutes to get settled. They have then missed

approximately 20 minutes of the lecture. Within those 20 minutes, a new topic could have been discussed or additional insight into a previous topic could have been presented.

Make an effort to get to your lecture early. It will aid in establishing your concentration and in the least, allow you to get a front row seat!

If you plan to take a course in mathematics, make sure that you are able to attend the class sessions at the time and place that they are scheduled. If you feel that you will have a problem with a particular schedule due to personal commitments, family matters or your job schedule, determine if there is some other class that would be more suitable.

IF YOU WANT TO DO WELL IN A COURSE IN MATHEMATICS, KNOW WHAT YOU ARE COMMITTING TO. UNDERSTAND THE COMPONENTS OF THE COURSE AND APPROACH THEM AGGRESSIVELY!

Chapter 10

TAKING EFFECTIVE NOTES

I consider note-taking to be very closely related to an art form. Some people do it very well while others can't even determine what they wrote when they review it at home. It is indeed critical for your success in this subject matter, to pay special attention to your note-taking abilities. If you are a serious student, and I am assuming that to be true, then the quality of notes that you take will lead to furthering your insight and understanding of the subject. Taking detailed notes in class is often difficult as a result of the pace at which the instructor conducts the lecture. However, details can be filled in later as you review your own notes or as you compare them to a classmate's notes.

Einstein on note-taking

Not that I want to scare you, but Albert Einstein discovered a valuable strategy for doing scientific research that can readily be applied to effective note-taking. Professor Einstein found that by laying out a subject in a self-contained, coherent, pedagogical manner, forces one to think about it in new ways. One is driven to examine all the subject's gaps and flaws, and seek cures for them. I realize that most students are not looking to reinvent mathematics or even to come up with extraordinary insight into the subject matter. Most are just interested in getting through the course! What separated Einstein from other physicists of his time was in fact his brilliant insight into that which he observed. For our more earthly purposes, we will consider later in this section, how we can apply his strategy for doing research to enhance your note-taking abilities.

Simultaneous Tasks Under Pressure

I've seen some students notes that seemed to include almost everything that I said in class. However, I've also seen notes that I could not understand. Consider the fact that when you are in a lecture environment, you are doing *two* things at the same time.

1. Listening to the lecturer.
2. Taking notes.

Which one takes priority?

There are times when you want to take notes so that you will not forget a key point. However, there are also times when it would be to your advantage just to just listen.

Enhancing your note-taking ability through the simple art of sharing.

Consider the following option that you have:

You make friends with another student in the class. You both attend lectures and both take notes. However, sometimes one of you takes notes and the other one just listens. Following the lecture, or at some later study session, you trade "notes". Some of the notes will be written while others will be mental notes. By comparing the two, many problem areas will be uncovered and clarified and you will be strengthening your understanding of the topic.

Coping with simultaneous tasks in lectures

In mathematics, your instructor will be utilizing significant board space or using an overhead projection system for displaying problems, equations, analysis, etc. Many instructors use prepared transparencies which they display on an overhead projection system. Some of these transparencies can

display a significant amount of information. While writing or displaying material, he or she will also be talking.

Now you have additional factors to contend with.

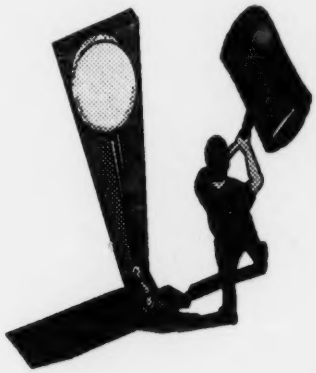
You are:

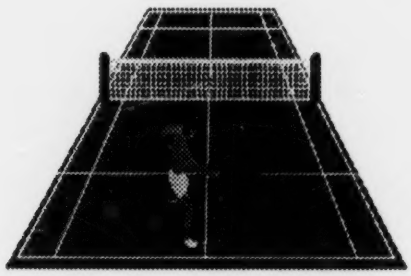
1. ***Trying to understand the material being presented.***
2. ***Trying desperately to take all of the notes that you can.***

3. ***Trying to listen to what the instructor is saying.***
4. ***Trying to copy material from a transparency display.***
5. ***Trying to keep your mind clear of personal matters.***

It is <u>impossible</u> to do all these things successfully! Something has to give.

You are stretching **yourself to your limit! You are going to end up feeling completely frustrated and exhausted at the end of the lecture if you try to successfully accomplish these "feats" simultaneously. Again, vary your actions. Don't subject yourself to a test of strength and stamina at each lecture!**





A note-taking strategy to promote your success

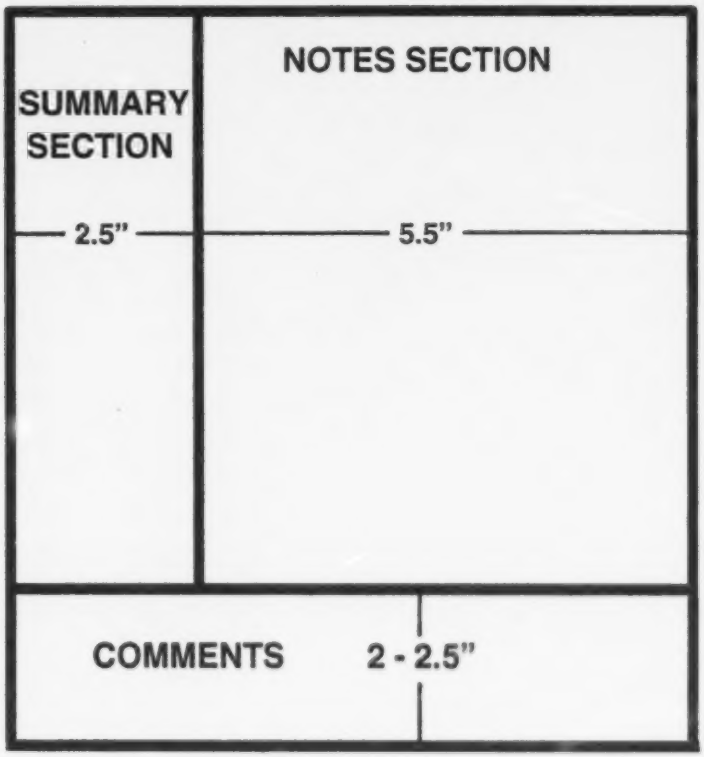
Earlier in this section I mentioned Professor Einstein and his ability to apply his extraordinary insight to problems that he encountered. He enhanced this ability by detailing the problem at hand, laying out all of the known facts in a clear and concise format and then just plain thinking about what he had before him. Let's now see how we can apply this concept to enhance our note-taking ability.

During my lectures, as I look out at the students sitting before me, I see most of them involved in vigorous note-taking. Some students sit and listen for awhile until they feel that they need to write something down. Others would write down every word that I said. Whether or not a student is capable of taking good notes during a lecture, is not the issue here. The issue relates to the format of their notes. There seems to be a common denominator in note-taking, as I peer out among the students. They all have their notebooks open and are scribbling page after page of notes. Often times utilizing every inch of space available to them on each page. Optimally, they could all go home following the lecture and rewrite their notes which also serves as a review. However, consider an alternative option which divides the note-taking page into sections.

Notebook Structure

Consider a standard 8.5" x 11" paper. Suppose that you were to only use a portion of that page for actual note-taking. Another portion for summary statements to be filled in following the lecture. Finally the last portion of the page to add your own comments, which like Einstein, will serve to further your insight into the subject matter. *(And you thought math was difficult, now we are making a "science" out of note-taking!!!)*

Divide each note page up as follows by actually separating the sections with ruled lines. The effort may prove to be worth it in view of what you will derive from this extended page format.



Now, let's consider the type of information that will go into each of the sections as well as the benefits of this format.

Notes Section

Just as you would normally take notes, the notes that you do take will all be entered into this section. Concentrate on doing as good a job as you possibly can, leaving spaces where you feel that additional information needs to be inserted. This additional information can be inserted at a later time, after you have clarified a specific point with your instructor or from a comparison of your notes with another student's notes. Again, it would be a good idea to

completely rewrite your notes as soon as possible following the lecture. This will allow for you to add additional comments, details, examples, etc. or things that you might have missed and obtained from a fellow student. Especially in a mathematics lecture, don't expect to take notes on every word and idea that is said by your instructor. The course material can at times be quite rigorous and sometimes just putting your pen down and listening can be just as important as taking meticulous notes.

Summary Section

This section is intended for use after the lecture. After you have either rewritten your notes completely or have added additional notes as a result of instructor clarifications or note comparisons from other students, you are ready to approach this section. What we are doing here is pulling out important concepts, key words or phrases, names of various methodologies or techniques, and stating these ideas in this summary section. This section does not contain all of the details that the note section contains. It will simply serve to lead you into thinking about the details of an idea or math technique, based upon a simple word or statement. It will be highly useful when it comes time to review for an exam. With ongoing review of this summary section, you will find that that details of the various techniques and processes, will become much more accessible when exam preparation is the "crisis of the moment"!

Comments Section

The structure of the note page is established to allow for what I call "revisiting" the concepts. Much if not all of the material that you are presented with in the lecture, will be new to you. It is going to take ongoing review and practice to master the concepts. A mastery of the material will also take something that should be obvious. That something is "thinking"! If you truly want to excel in the subject or often times just get through it, you need to establish a means by which you can develop mathematical thought processes. Oh No! Did I say mathematical thought processes? Don't become upset just yet. This process that we are establishing here will work for you!
In this section, you will begin, believe it or not, to think about the notes that are staring at you on the page, in a new and personally meaningful light.

- What kind of applications do these concepts have in the "real world"?
- Are these concepts meaningful or useful to you in your current job or future profession?
- How do these concepts strengthen what you have already learned or form a basis for that which is yet to come?
- Can I add anything to the processes presented that would simplify any specific item? Is there any room here for personal creativity?

These are just a few of the types of questions that you might want to ask yourself when completing this section.

The Note Page - Illustrated

Here are examples of completed note pages based upon topics taken from math lectures. The lectures which represent the basis for the following pages, deals with three areas of mathematics as examples.

1. Basic Mathematics
2. Statistics
3. Trigonometry

Review these pages and the note taking strategy. See if you can apply it to your note taking. The strategies presented can work for you! It will give you the ability to further your insight into the subject area and allow for your personal success beyond that which you may have thought possible!

Summary

Part of a whole.
Need in daily life

- Structure
- Components
- Numerator
- Denominator

a/b structure

- Dividing sign
- Fraction of a whole

Example :

is/of computation

Notes

Fractions or parts of something that is whole, are important computations.

- involved in computing fractions in our daily lives.

Structure of a fraction

Two components plus a dividing sign.

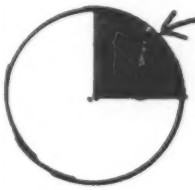
- Made up of both a numerator and denominator.

Let a = the numerator.
Let b = the denominator
then: the structure of a fraction is: a/b
where the "/" sign is a division or dividing sign.

$$\frac{a}{b}$$

a <-----numerator
b <-----denominator

Suppose that we have a whole pizza pie:



Fraction of the pie
(Shaded portion represents 1/4 of the whole pie)

Since we have 4 equal pieces
What fraction of 5 is 1?
What fraction of 256 is 45?
Represent as is/of : where 1 & 45 = is
and 5 and 256 = of. then is/of = 1/5
and 45/256, respectively.

Comments

- During the past week, where have I seen fractions used outside of the classroom?
- How do fractions relate to what I already know?
- What does the denominator really represent?
- How would I calculate what the note section of this page is as a fraction of the entire page?

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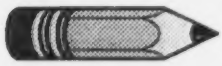
Statistics - Lecture Notes(Page Layout)



Summary	Notes
	Introductory statistics lecture
Statistics Definition	Definition given in class: "Statistics is a process of collecting, analyzing and presenting data thereby transforming that data into useful information".
Areas of discussion	Study falls into three main categories: 1. Descriptive Statistics 2. Inferential statistics 3. Probability Theory
Descriptive Stat.	Descriptive statistics focuses on summarizing and presenting data. Refining and describing data so that the numbers become more meaningful.
Inferential Stat. -subsets	Inferential stat. deals with large data sets. Conclusions or inferences about an entire data set based upon the study of a subset.
Probability Theory	Probability theory is the study of the likelihood or chance that an event will occur. - link between descriptive and inferential stat.
Specific Definitions - Statistics - Average	Statistics is the science of inferring generalities from specific observations. The simplest of all statistics is the average. $(1 + 2 + 3 + 4 + 5)/5 = 3$
Calculate average on calculator.	Instructor showed computation on calculator!
Raw Data	Raw data is data used for statistical analysis.
Survey	A survey is the process of collecting stat. data.

Comments

- Where have I come across statistical data presented to me today outside of class?
- What is the importance of learning the statistical terminology?

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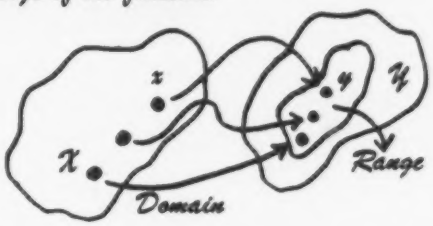
Summary	Notes 6/16
-Sets of numbers.	Correspondence between two sets of numbers.
- Revenue Equation	Revenue from the sale of x items as a function: i.e.: $R = 10x$ where \$10 is the sales price of each item.
- Definition	Definition Let x & y be two non-empty sets. Function from x into y associates with each element of x a unique element of y.
-Domain	Domain = set x for each x in X.
- Value	the corresponding y in Y is the value of the function @ x.
- Range	Set of all values of the elements of the Domain is called the Range of the function.
-Diagram	Diagram: 
- Equation with restriction for x:	Example 1: Given $y = 2x - 5$ is a function. Domain: $1 \leq x \leq 6$: restriction
- Description of functional notation.	If $x = 3/2$. what is y? Description: $y = f(x)$
- Eg. statement	Convert ex.1 to $y = f(x) = 2x - 5 = f(3/2)$

Comments

Can a value of x generate two values of Y? Y would not be unique for a single value of x.

How can functional equations be applied to business applications?

Are functions different than ordinary equations in their solution?

Can functions be graphed? Try it on an electronic calculator!!

The previous pages outlined a plan that you can use for page formatting during and after your note-taking sessions. You should make it a point to review the summary sections of each note page on a regular basis. When you take notes and fill in the summary section, cover the rest of the note page and see if you can relate the words or phrases listed in the summary section to the body of your notes. Each word or phrase should be sufficient to allow you to detail the concepts behind each word or phrase.

If you get into the habit of using this strategy, you will be much better prepared when test time comes and better able to comprehend new information.

Plan of Action:

1. Take detailed notes when you feel that it is necessary.
2. Sit and listen and fill in your notes at a later point in time.
3. Concentrate on understanding the material being presented even if you have to sacrifice taking immediate notes on the material.
4. If allowed, you might want to use a small tape-recorder during class. This will minimize your note-taking and maximize your listening time.
5. As mentioned earlier, if you are studying with a partner, what you may have missed in your notes you may be able to get from your partner.
6. Use the formatted page structure presented in this chapter.

Something that you might want to try is to rewrite your notes at home following the lecture. There are many reasons why this practice will help you to succeed in understanding the subject matter.

1. Notes are just what they mean...*NOTES!* They do not represent a detailed reiteration of what someone has said. In rewriting your notes at home, you can fill in the details.

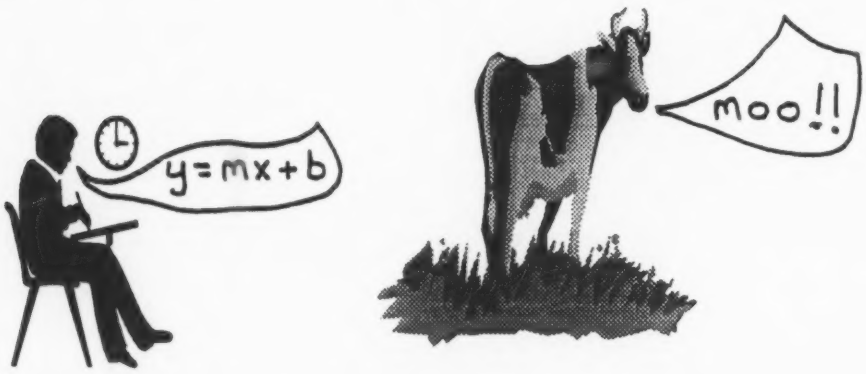
2. By rewriting your notes, you will uncover areas that you may feel uncomfortable and this will help you to develop questions that can be raised at your next class meeting.

3. **Rewriting your notes will serve to reinforce that which you have learned in class. You will essentially be sitting through the lecture again, but now at your own pace.**

4. **I prefer to call the task of rewriting ones notes a "re-assessment" of that which you have already learned. You are essentially teaching yourself the material by re-stating it in your own words. What better way to understand a subject then by explaining it to yourself and stating that explanation on paper!**

While I am on the subject, an excellent way of learning and re-stating your notes mentally is to explain it to someone. Find someone who is willing to listen to you explain that which you have learned. That someone can be a member of your family, a friend, or a fellow student.

I'm not saying that it is going to be easy to find someone who will listen to you talk about mathematics, but if all else fails...



Using effective note-taking strategies at each lecture will allow you to walk away with a "statement" of your learning. It will serve to supplement that which is found in your textbook and is an excellent reference source while preparing for exams. In the final analysis, the practice of taking notes is different under different situations and by different individuals. You need to establish your own note-taking strategies given the guidelines set forth, your writing ability and the presentation methods of your instructor.

Chapter 11

ASKING QUESTIONS IN CLASS

After much deliberation, I chose to include this section in response to an often times lack of questions during lectures. Understand that questions raised by students during a lecture, give the instructor vital feedback in relation to the class comprehension of the material. In addition and most importantly, asking questions will immediately clarify an instructor's remarks at the time that they were made. Certainly, there are some instances when the instructor will request that no questions be asked in order to prevent an interruption in the flow of the presentation. However, most times the instructor will welcome questions.

Don't let your instructor talk endlessly if you are lost or have missed a main point. **Many instructors will continuously ask for questions. Others will just go on and on, considering it a blessing that no one interrupts them with a question. Don't give them that blessing! Don't hesitate to ask questions. It will help you to better understand the material presented and help others who had the same question! It will also help your instructor and many instructors need help!!!**

Why You Should Ask Questions

I have found in many classes that there are a certain number of students who always ask questions. I have further found, and I make no claims to the validity of this, that the students who frequently ask questions are the students who sit up front in the class. Some students will not ask any questions throughout the entire semester.

Consider the fact that when you are sitting in a lecture, you are usually being presented with new material. If your instructor just explained something and you are unsure about this new concept, be sure to raise a question. I guarantee that the same question is on the minds of fellow classmates! If you walk away from a lecture with an unanswered question, it will be all the more difficult for you to remedy the problem at home.

Asking questions in class serves many purposes, some of which are as follows:

1. Serves to answer *your* specific question or concern.
2. Your question may be on the minds of your fellow students.
3. Serves to break up the pace of the lecture.
4. Gives the instructor ongoing feedback in relation to the class understanding of the material presented.
5. May result in additional discussion of the topic by the instructor.
6. Will allow you to further detail your notes for easier review at a later time.
7. Will inform the instructor that you are listening.

Wait a minute! Why am I even bothering telling you what the value of asking questions in class is? It should be obvious to you!

The classroom should not be conducted as a one-way session!

The learning environment of the classroom should be developed as a "two-way" session. Both the instructor and the students should participate in the

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presentation and learning of the material. Certainly, the instructor is going to be doing most of the presentation and the students are going to be doing most of the learning. But keep in mind that an instructor who is of any value to his or her students, understands that he or she will benefit from questions raised by the students.

Using Questions To Break Up The Pace

Instructors will sometimes get carried away with the lecture presentation. Possibly some difficult concept is being presented or just something that they have alot to say about. You might feel that things are going a bit too fast for your understanding. The instructor seems to just be going full steam ahead!

Things are getting out of control! The lecture is running away with itself!

Now is your chance! Ask a question! The result is a break in the flow of the material. Hopefully, it will slow things down somewhat. If enough questions are asked, it may give the instructor the subtle hint that maybe he or she is going too fast. You will be the one who will benefit.

If you are trying to learn mathematics, there will undoubtedly be many questions that you need answers to. By clarifying any stumbling blocks at the time that they are realized, you will make life easier for yourself when you review the material alone, attempt to solve homework problems, and prepare for exams.

Preparing Questions In Advance

Each night, or before each lecture, there will undoubtedly be questions that arise in your mind while reviewing your notes. You may encounter problems with the methodology involved to solve a specific problem. Or, as frustrating as it sometimes becomes, you may encounter a problem that you just cannot solve. Write down the questions that arise or problems that you encounter, when you are reviewing your notes or attempting problem solutions. Bring these questions with you to class. Attempt to raise some of these questions with your instructor either before, during or after class. If you cannot get an answer from your instructor, ask one of your classmates if he or she has experienced the same problem. There can be nothing more instructive then problem resolution among your peers.

Fear Of Asking Questions In Class

Don't be afraid to ask questions during lecture. Don't be intimidated by the other students and afraid that your question will sound "stupid". That same question might also be on the minds of other students! It is not unusual for an instructor to make an error during the lecture. That error can come in the form of something written on the board or through some statement made. If you feel an error has been made, raise your hand and ask for clarification. Yes there are still some instructors who will acknowledge a mistake that they made and thank you publicly for pointing it out. Just think how good you will feel if you point out an error and the instructor acknowledges it as an error and the rest of the class makes the appropriate correction.

Sometimes you may think that an error has occurred when it in fact has not. However, an error may have been stated and you could be right! Don't hesitate to ask a question during lecture, correct what you consider to be an error or answer a question raised by your instructor. Try to overcome the hesitation that most students face in answering an in-class question ... ***the fear that they may be wrong!***

If it is any consolation, consider the fact that even a broken clock is right twice a day!

Chapter 12

STUDY GROUPS

What better way to learn then to get into the habit of discussing the subject matter with other interested individuals. Did I hear you say, that's impossible! Where am I going to find other "interested individuals", who are "interested" in studying math? Well, you have a whole classroom full of those "interested individuals"!

It was mentioned earlier that it is a good idea if you become acquainted with some of your fellow classmates. That acquaintance will certainly come in handy in forming a study group although students in other class sections, can also be called upon to join the group.

Definition Of A Study Group

"A group of students, maybe two to four, whose objective is to enhance the learning process through group meetings, discussions and group problem solving. It is a give and take meeting whereby topics can be discussed or specific problems resolved that are common to the participants. It is a time when notes can be compared and problem areas aggressively approached and resolved to the benefit of all involved".

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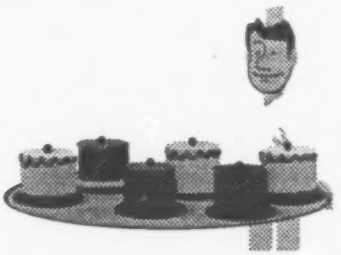
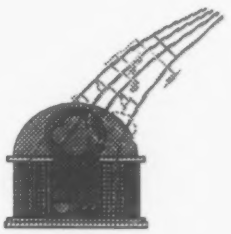
Study Groups As A "Limited" Social Function.

A study group can also become a "limited" social function. Order a pizza or deserts and make the "task" of studying more fun. Just keep in mind that you do not want to turn the study session into a party! However, I believe that some enhancements such as snacks, can make the session even more productive and slow the onset of fatigue.



Defining Group Objectives

However you plan your study group, be sure to define the objectives of this "meeting of the minds" beforehand and stick to them. You want to make the study session productive. Your study group can meet either during the week or at a mutually agreeable time on the weekend. Make sure that there will be no distractions at the location that you plan for this meeting. No loud television coming from another room or other people running in and out and disrupting your discussion.



Possibly you can arrange for ongoing study groups each week at the same time. Each session can last only an hour or two as long as the session is meaningful and you feel that specific problem areas have been resolved. A study group is an excellent way to help you overcome many of the frustrations

that you will encounter in mathematics. You want to be certain that each of the participants is serious about getting certain things accomplished and will be an active participant to the group. You might want to set up a chalk board or easel if you have one, to make it more like a classroom environment. This will add to the seriousness of the meeting.

It can certainly prove to be very rewarding to allow for the opportunity to learn from your peers. Not only is it a refreshing break from the structured learning environment of lectures, but it also allows for a comfortable environment within which the exchange of ideas and concepts can occur. Be aware that you can learn something from each person that you know and they can benefit from your ideas and comments.

Learning From Others

Consider the question of who your favorite teacher was. Which teacher made the biggest impact on your life? Let your mind wander over the years and through the classrooms, from nursery school through higher education.

When we are young, we learn from all of our teachers because there is so much to learn, so many new concepts, so many exciting new areas to explore.

And, of course, because to us, the teacher knows [just about] everything. In our youngest years, our most memorable teachers are often those with the twinkliest eyes, the most creative ideas, the kindest demeanor. As we get older, though, we expect more out of school, and more out of life. Teachers of the "Mickey Mouse" courses or "easy A" classes are almost never memorable. Our favorite teachers from our more mature years are usually not the ones in whose class we had a good time, but rather, the ones who pushed us, who made us work, maybe even helped us to excel for the first time ever.

We might even go so far as to ask the question, who is wise? It seems that a logical answer might be, one who learns from every person. In other words, one is wise who can state that they have gained wisdom from all those who have taught them. We are not being told to harken back to our childhood when we learned from every teacher without exception or discretion. We are expected to do exactly what we did for the demanding teacher-work hard, strive toward something, eventually succeed and become all the better for it. In this instance what we are striving and working towards is the ability to learn from everyone.

As in most courses of worth, there are prerequisites. An important prerequisite to this course of action is to subjugate one's ego. After all, how can I possibly expect to learn from others if my ego keeps getting in the way, telling me that this teacher doesn't practice what he preaches, or that teacher doesn't understand the material very well, or he speaks in a monotone, or I learned it already from a better teacher, etc.

If we were to further define a wise person we can come to some very interesting conclusions. First, just by being willing to learn from everyone allows us to be called a wise person. For with this healthy attitude we will ultimately become wise and better our understanding of that which we may being having difficulty with. And who is a wise person? Not simply someone who learns. Certainly, the world is made up of an abundance of educated derelicts! There are plenty of people who are "book smart" but we wouldn't necessarily call them wise, right?

So having knowledge, even acquiring knowledge, is not really the definition of a wise person. A wise person is one who will look for something good that he can learn from another person. Whether a piece of knowledge or a good character trait to emulate, the wise person will find something even in a person who is of lesser stature than himself. The ability to find in even the simplest person a good trait or insight is something that only a truly wise person can do.

Personally, from all those who have taught me, I have gained wisdom. Our pursuit of "knowledge" should truly be a pursuit of becoming a wise person-a person who finds good in everyone and is open to the free exchange of ideas. Ultimately, this will have the effect of enhancing our wisdom.

To review:

1. Acquaint yourself with fellow classmates.
2. Discuss the possibility of forming a study group.
3. Arrange a suitable time and place for each study session.
4. Establish specific learning objectives for each session.
5. Allow enough time to accomplish those objectives.
6. Plan on making the study group fun by introducing some social aspect.
7. End the meeting when all objectives are accomplished and the consensus is that you all had enough of mathematics for one day!

Chapter 13

DOING YOUR HOMEWORK ASSIGNMENTS

The Philosophy Of Homework Assignments

Regardless of your age, try to recall the early stages of your education in elementary school. Yes, even then their was homework! Teachers then and instructors now, do not give homework assignments to improve their personal health. Checking, recording and monitoring student's homework assignments can be an extremely time consuming and often boring task for any instructor. It significantly adds to the instructors paperwork and course administration practices. Honestly, it would be much easier, if instructors could trust students to review their course material and do problems on their own, without giving them homework assignments. However, that never seems to work.

Instructors choose specific problems from a textbook or other source, to insure that students will attempt problems that will develop their understanding of the lecture material. The number of problems that they assign is a personal matter, depending on the level of the course, the difficulty of the problem sets, problem diversity and how much repetition they feel is necessary for students to learn the material.

I assign problem sets to my students but I make it a point to inform them that I feel the assignment covers a diversity of problems necessary to achieve an understanding of the topic. However, I tell them that I am not going to count their completed problems to determine if they conform to my original assignment. If a student feels that they have mastered a topic after doing 5 problems of the same type, I personally feel that they don't need to do an

additional 5 problems. That is my policy. You will have to deal with your instructors policy. Either way, homework assignments play a critical role in your success in the course. You are not doing these assignments to satisfy the instructor. You are doing them to learn the material. If you keep that in mind, you may develop some degree of pleasure and achievement when you complete an assignment.

You are becoming an educated person, whether it be through your increased abilities in mathematics or your increased knowledge of any other subject. Your increase in knowledge will bring you to a new plateau in your education process. You will never again fall back to your previous level since you have now acquired new knowledge. You are developing your mental skills which will remain with you throughout your life.

You are learning by developing your own personal success practices and altering your previous attitude toward education to conform with your thirst for knowledge. Certain rules and personal practices need to be adhered to in order to develop this increased knowledge. Placing emphasis on homework completion is one of those practices which will add to your success in your studies.

JUST DO IT!

Like anything else that you want to become proficient at, learning mathematics takes practice. That practice comes from doing the problems assigned by your instructor. Every mathematics textbook has a set of problems following each section or at the end of each chapter. Many textbooks have a review test following each chapter which test your understanding of the topics covered. It is not a question of what your instructor assigns but rather what it takes for you to learn the material. If you

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feel that you need to do more problems then was assigned, do it! Don't constrain your learning to solely satisfy the demands of your instructor.

Doing Problems

Before you attempt to do the assignment, review the section in your textbook that deals with that assignment. Also, review your notes that relate to the assignment. When you feel that you have a sufficient understanding of the material, then attempt the problem set. Refer to your notes and the problems solved in your textbook to complete each homework problem. You are going to encounter many problems that you cannot immediately resolve. Make your best attempt at them. If you still can't solve the problem, leave it and go on to the next problem.

Often times by doing additional problems you will become more proficient at solving them and learn various techniques that you can then apply to the problems that you were having difficulty with. Don't drive yourself crazy with a problem that you can't solve! Before you become frustrated, take a break for ten minutes and then come back and attempt the problem again.

Getting Assistance With Tough Problems

Note the problems that you have difficulty with and bring them to the attention of the instructor at the next class meeting. Many times you will find that you overlooked a simple concept or technique which will then allow you to immediately solve the problem. As mentioned in the preceding section, here is where the use of a study group can assist you. All it takes is someone else to inform you of an alternative approach and then you have it! Think of it as a personal challenge. You will find that it is a relief when a difficult problem is finally resolved. However, by working on that problem and trying different approaches, you are actually developing a much greater understanding of the subject.

Developing Alternative Problem Forms

When you complete a math problem, ask yourself the following questions:

- **What if the problem was altered slightly?**
- **How would a change in the problem, affect the solution?**

Don't expect your instructor to ask you the exact same problems that you have been solving in your homework assignments, on exams. In many cases, the problems that you will see on exams will be somewhat different then that which you might be accustomed to. Get into the habit of continuously challenging yourself with different versions of the same problem. There is no "STOP" sign

at the end of each problem that says, "once this problem is completed...STOP!, forget about it and go onto the next problem". Keep asking yourself, "what if this were to be changed?" or "what if the problem read differently?" You will find that you will become better prepared to handle variations of your homework problems that appear on upcoming exams.

Problem Solving Reinforces Your Learning

Whether or not your instructor grades your assignments and counts them as part of your term grade, does not change the fact that completing these assignments are for your benefit. Your instructor already knows the material, you are first learning it! In mathematics, do what it takes to learn the techniques to solve the multitude of problems that you will be faced with. Again, the only way that you will learn this subject is by practice. Taking your

homework assignments seriously and continuously reinforcing your learning with more problems, will eventually bring you the rewards that you deserve.

Chapter 14

PREPARING FOR AND TAKING A TEST

I guarantee that the first student who ever took a test in some ancient educational setting, had the same apprehensions and nervous feelings as you might have when you take a test. Possibly they had to etch their answers on some stone tablet! That's what I call a "hard" test! There is an abundance of material written by numerous "experts" on how to take tests. However, each individual has to develop their own approach to test taking. To do well on tests you need to develop a high degree of confidence in yourself that you are in fact prepared to do well! You need to maintain a strong positive attitude that will carry you through the exam successfully.

Confidence

I cannot over-emphasize the word **CONFIDENCE!** It takes confidence in oneself that their prior understanding of the material and all of the work that they have put into their learning, will pay off at test time. Consider the fact that when you take a test you are simply proving to yourself that you have an understanding of the concepts that you learned. Study your material until you feel that there is nothing that can be presented to you that you can't handle. That's confidence! Yes, even you can develop it!

Planning Your Study Time

Assuming that you know in advance when your tests will be, you can plan your studying accordingly. Don't leave your studying for the last minute, searching for things that you feel that you should understand.

That will only get you upset with yourself if you run into some difficulties when reviewing the material. You do not want to take a test feeling that you are not prepared. If you leave yourself enough time for studying before a test, you will be prepared.

Study Guidelines

Try to follow these simple guidelines when studying for a test.

1. Ascertain beforehand what the test will cover. See if you can question your instructor to be specific as to which topics will be included on the test and which topics won't. This will avoid your wasting time studying a topic which will not be on the test.

2. Determine how much time you feel that you need to prepare for the exam.

3. Review your notes that relate to the material on the test. Are there any problems that were given in class that you feel certain will appear on the exam? If so, concentrate on those problems until you feel comfortable with them.

4. Review the pages in your textbook that contain the information which will be covered on the exam. Redo whatever homework problems that you had difficulty with.

5. Put yourself in your instructor's shoe's by asking yourself what types of problems *YOU* would ask on an exam. Be tough with yourself.

6. Giving yourself enough study time before an exam will allow you to concentrate on each topic slowly. Review all of the problems that you can that relate to each topic. Again, as you go through the problems, ask yourself how you would alter your approach to the problem if something was changed. Your instructor will be thinking this way.

7. As a final point in this section, if you still have problems with math, if you have done everything possible, but still can't get it, then I am going to make a ***bold*** statement to you.

   LEARN THE MATERIAL MECHANICALLY! If you learned a specific technique that relates to solving a specific type of problem, do as many problems as you can so that you can reiterate that technique on the exam. In lower level mathematics courses, many instructors give what I call "form" tests. These tests ask you to solve problems very similar to that which you have already had in class or for homework.

   There is no reason why you can't do well on these types of tests even if it means doing the problems "mechanically". By "mechanically" I honestly mean without a mathematically understanding of what you are doing!

Topic Specific vs. Cumulative Exams

A topic specific exam is an exam that covers specified topics or problems. I like to think of this as a "subset exam", or an exam that covers only some of the topics out of all of the topics that were studied. With this type of exam, you can determine specifically what those topics are and establish your study time accordingly. Students are quick to ask, "Exactly what topics will be on the next exam?" Your instructor will usually inform you of the topics that he or she plans to put on the test. However, understand that in mathematics the concepts are cumulative in nature. This means that each topic is built on your prior knowledge and understanding. Especially in lower level math courses, if you have problems with a specific topic, and those problems are not resolved, you are heading for even more problems with the next topic.

If your exam is "topic specific", then you should know exactly what to study. Focus in on those topics and learn them well. Do as many problems as you can that deal with those topics. Re-read your notes and ask yourself how these topics relate to topics that you have already learned. You may need to review a prior chapter in order to form a stronger basis for thoroughly learning the topics that will appear on the next test.

Most students become rather fearful when they are confronted with a "cumulative" exam, especially a cumulative final. Again, be aware that math is cumulative by its very definition. When you learn something you are going to use it again in future topics. Through a cumulative exam, your instructor wants to test your ability to integrate the material learned into general problem solving. No single cumulative exam will test you on every topic that you have learned during the semester. However, specific problems can require a knowledge of numerous topics. You will certainly need more time to prepare for a cumulative exam than you would for a topic specific exam. If you know that you have a cumulative exam coming up, such as a final, you should start reviewing at least two weeks prior to the test date! Schedule your study time and topics that you want to review. Stick to this schedule and concentrate on an understanding of all of the topics involved.

Don't become all upset at the thought of a cumulative exam. It just requires increasing your study time. For a math course, you should be studying on an ongoing basis. Studying for a cumulative exam should be nothing more that a review. Use your previous tests as a guideline for studying for this type of exam. Redo any tests that you had difficulty with.
Many newer math textbooks contain chapter summary tests at the end of each chapter. Some have cumulative tests after every two or three chapters. If your book contains these types of practice test, do them! That is probably one of the best ways to study for a cumulative exam and determine areas that you may have to go back to review.

"Creative" Exam Problems

At certain levels in mathematics, your instructor may expect more from you on exams then just solving problems that you have already seen in class or as a homework assignment. These type of tests are aimed at separated the "above-average" students from the "average" students. You can't really prepare for these types of exams since you don't know how creative your instructor is.

I sometimes throw in some "creative" type problems on my exams. They just require that the student think about what is being asked and what techniques they have to solve the problem. My feeling is that all of the students should have acquired the knowledge base to solve the problem. However, many students find it exceedingly difficult to apply what they know to a new application. The way to prepare for these type of questions is to know the subject matter very well and have played the "what if" game during your studying. Namely, "what if" the instructor takes this information and structures it into an unfamiliar format? . The test taking environment itself makes the task even greater. I would not worry too much about this, especially in lower level courses.

Your objective is to learn the material so well that there is no question that you can be presented with, that you could not answer.

Test Taking

With the arrival of the test day, there is no doubt that your anxiety level is probably at an all time high. However, if you concentrated on your studies, your confidence level should also be high. Don't start worrying about what if the instructor makes the exam difficult or what if there are problems that you can't do. Those things are out of your control. If you did all that you could do in terms of your preparation, then feel confident that you know the material and anything that you encounter, you will be able to handle.

Get Me To The Test On Time

It is important that you plan on arriving at the test early. You need the extra time to get yourself settled, review any note sheets that you may have, get your calculator out(if you are allowed to use it) and put your mind in "test-taking" mode!

Structuring Your Time

Using your time correctly is critical to your success. Your instructor will indicate to you how much time is allocated to the exam. Don't immediately feel that you don't have enough time to complete the exam. Keep your thoughts positive. YOU ARE PREPARED! Read the test instructions and listen to any other directions that your instructor gives you. Look over the test and determine the type of questions that are presented. There is no law that states that you must do the first question first. Begin the test with the question that you feel most confident in answering. This in itself will maintain your confidence level. After completing the easier questions, move on to the more difficult questions. Read the question twice. Determine what it is asking and what you need to solve it, such as an equation.

Is This A Tric! Question?

When my students encounter a question that they are not used to seeing they immediately consider it a trick question. Don't make that assumption! Most test questions are not trick questions. Deal with the problem just as you would with any problem. Read it. Ask yourself what it is asking you to do. Ask yourself what you need to solve it.

Problems Built Into Statements

Let's consider two types of test questions that I gave my students in a basic math class. If you are more advanced, I apologize in advance for insulting your intelligence. The test related to percent and decimals and their associated conversion. One problem on the test was as follows:

1. State College annually receives 5000 applications for its freshman class. If it accepts 400 of these applications, what percent does it accept?

No problem you say? Just take the 400 and divide it by 5000 and there is your answer.

400/5000 = 8%

However, another question on the test read as:

2. Ms Smith, a local real estate agent, recently listed a house with a selling price of $384,000. Two days after the listing was released, the house was sold by the team of sales agents, Mr. I. C. Money and Ms. Penny Pincher. They were both from the real estate firm of Wheeler and Dealer, Inc. The listing contract stated that a commission of 6.5% of the selling price upon sale of the home was to be earned by Wheeler and Dealer, Inc. It was the policy of Wheeler and Dealer, Inc. to keep 50% of the commission and give 60% of the remainder to the listing agent and give 40% of the remainder to the sales agent(s). Mr. Money and Ms. Pincher had always split their team commission at the rate of 70% to Mr. Money and 30 % to Ms. Pincher, since Ms. Pincher was new to the business of selling real estate and Mr. Money was a veteran real estate salesperson.

The person who bought the house put 20% of the purchase price down and financed the balance through a local bank.

(a) How much(in dollars) was earned by Ms. Penny Pincher in this transaction?

(b) How much(in dollars) was earned by Mr. I.C. Money?

(c) Approximately how much interest will the buyer of the house pay on the loan through the bank during the first year, if the interest rate on the loan is 10%?

(d) Will Wheeler and Dealer, Inc. be able to fully finance some new office equipment will cost $15,986 from the proceeds that they receive from this sale?

As far as I am concerned, there is not much of a difference between the first and second problem. The second question is not a trick question. It is an application problem of the "real-world" kind. You do not need to have a real estate knowledge background to answer it. Obviously this is the type of question that you need to read more than once! The solution only relies on the students ability to extract the information that they need, and accomplish the necessary basic math computations. The question stated that a 6.5% commission was to be earned by the Wheeler and Dealer Company. Therefore, 6.5% as a decimal is .065, and

(.065)($384,000) = $24,960, the amount earned by Wheeler & Dealer.

Since Wheeler and Dealer keeps 50% of the commission, then,

(.50)($24,960) = $12,480, that Wheeler & Dealer keeps.

Obviously, now you see that part (d) asked you if the company will make at least $15,986 from the transaction, they won't!

It was the company's policy to give 60% of the remainder to the sales agents and 40% to the listing agents. The problem stated that Ms. Pincher and Mr. Money sold the house, so they were the selling agents and receive in total 40% of the $12,480 or (.40)($12,480) = $4992

Since Mr. Money and Ms. Pincher split the total commission coming to them at the rate of 70% to Mr. Money and 40% to Ms. Pincher, the computation as to how much each earns is as follows:

(.70)($4992) = $3,494 goes to Mr. Money

(.30)(($4992) = $1,497 goes to Ms. Pincher

That answers part (as) and (b).

Since the buyer put 20% of the purchase price down and financed the balance,

(.20)($384,000) = $76,800 was the buyer's downpayment.

therefore, $384,000 - $76,800 = $307,200 was the amount that the bank financed.

At a 10% interest rate during the first year,

(.10)($307,200) = $30,720, was the approximate amount that the buyer paid in interest during the first year.

Problem Completed!

Could you have handled this? Look at the computations. They are simple percent and decimal computations. Here is an example of where you need to read the problem, determine what is being asked, know what the necessary computation are and do them. This was not a trick question but rather a very real problem that made use of decimal and percent computations. You needed to extract the relevant information and base your computations on that information. If you understand the related topics, there is no reason why this problem should be anymore difficult then the first problem. Sure it will take longer, but hopefully your instructor took that into consideration and you used you time wisely!

Showing Your Work

Unless you are answering on a scan sheet, show all of the work that you do in relation to any problem. Even if a problem is answered incorrectly, you might still receive partial credit for your work. Don't leave any problems blank. Attempt every problem. Write something even if it is just a word explanation of how you would attempt to solve the problem. You get no credit for no answer, so you have nothing to lose!

Tips On Solving Math Problems

Let's summarize some of the points made previously and add some new ones.

1. Read the directions on the test.
2. Scan through the test and do the easier problems first.
3. Read the problem twice.
4. Extract the relevant information.
5. Determine what is being asked to prove or solve for.
6. Determine what equations or computations are needed to solve the problem.
7. If possible, try to estimate the answer, so you will have an approximate idea of what the answer should be.
8. On the second problem that I presented, you noted that the part (d) answer was simple to calculate and was calculated first. Sometimes you need to work backwards in a problem.
9. After the computations are completed, re-check your thinking. Usually your first answer is correct. But if you find an error, change it.
10. Don't let people who complete the test early affect your confidence. Many of the people that you might see who leave early, left because they could not complete the test.
11. After you complete the test, review your answers. Consider the logic behind your answer. Does your answer make sense?
    In relation to the second problem that I presented. One of my students calculated that the Company would earn $249,600, based on a 6.5% commission.

They stated this because their computation was:

($384,000)(.65) = $249,600

They obviously forgot to convert the 6.5% to its decimal form of .065. this error should have been obvious from logic. A company does not earn a commission of $249,600 on the sale of a $384,000 house! You don't need to be a real estate tycoon to know that. It's common sense! That mistake made all further computations wrong!

Getting Your Test Back

When your instructor gives you back your exam, review it for possible grading errors. Do the test again to determine where you made your mistakes. Understand why you made those mistakes so you won't make them again. You have only yourself to blame if you did poorly.

The instructor is not out to get you! He or she may look mean, but in the final analysis, they are only trying to teach you that which they know and you need to know!

Personal Evaluation

It may be a good idea at this point to write down some of the problems that you have when taking a test. In other words, write down the weaknesses that you have. Write either a word or a statement. Let me start you off with a common weakness.

1. When taking a test, my anxiety level increases so much that I forget what I thought I knew.

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Now, write down how you plan to overcome these weaknesses.

1. **Through my test preparation, I will learn the material so well that my confidence will outweigh any anxiety that I may feel.**
2. _____

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Overcoming Test Anxiety

There are many factors that contribute to test anxiety. The results however, are all the same. I have seen many times where a student would get up after fifteen minutes of a two-hour test and approach me in absolute frustration.

> **"Professor Greenman, I studied for 20 hours for this test and I can't do a single problem"!**

Alternatively, I see students who seem to be working intensely on the test but still achieve a low grade. When their paper is returned, their response is that they completely blanked out. What is this "blanked out" business. I didn't see them fall on the floor! Better yet, there is the old "mental block" excuse.

"Professor Greenman, I am sorry that I did so poorly on the exam. I studied for three days, and knew the material, but I had a mental block during the exam!"

Instructor's response:

"Excuse me, but I did not see any cement pouring out of your head! Nor have I heard of any scientific evidence proving that a small brick wall actually separates the two halves of your brain!"

Outside of obtaining professional counseling, on how to reduce anxieties that you have, you can simply reduce these possibilities by knowing the material well. There is no substitute for acquiring a sufficient knowledge base to counter any mental block that you might feel coming on.

When you have doubts about your knowledge of the subject, and your confidence level is affected, you inevitably invite "test anxiety" to strike!

So there you are, sitting at a test, that you thought you studied enough for, but you can't do some of the problems! Your anxiety level heightens! Oh no! You are now having difficulty with even the easier problems! If you fail this test you may not achieve the grade that you need to maintain your GPA. Worse, this is your last course requirement needed for graduation or transfer to another school. **Your anxiety level is now going through the roof!!!**

STOP!! and get hold of yourself. Don't let this happen to you. Know the strategies on how to prepare for a test. Know the material that will be on the test.

Have confidence in what you know. As far as you are concerned, there is nothing more to know for purposes of taking this test. If you can develop your confidence level to that point, then you will not experience any "test anxiety" nor will a group of tiny bricklayers suddenly appear in your brain to erect a "mental block" wall!

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Chapter 15

MATHEMATICAL PROBLEM SOLVING

In mathematics, no matter what course you are taking, the number of problems and the diverse character that these problems can take, will seem endless to you. As you attempt to solve some of the problems that you will encounter, you may at times feel that you are just going around in circles.

However, do not become frustrated before you even begin. There is a logical way to approach problem solving in mathematics. That is not to say that a specific approach will make all problems that you encounter easier. It will only offer you a methodology to approach the general concept of problem solving. Often, it is up to you to develop your own problem solving strategies. Consider the fact that math was developed for the sole purpose of solving problems. When students ask, "When will we ever need this math?", the answer is quite simple. The development of mathematics goes back to ancient Egyptian and Babylonian cultures. Much of it was developed then specifically for problem resolution and it remains with us today for that same purpose.

Inductive/Deductive Reasoning

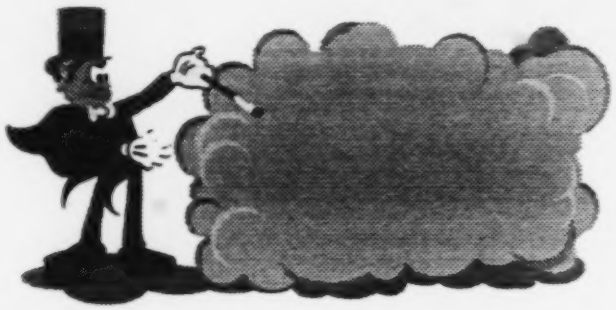
Back in the time of the early Egyptian and Babylonian era (3000 B.C. - A.D. 260), specific mathematical techniques were performed repetitively to solve similar problems. If a specific approach seemed to work for a particular set of problems, it was concluded that the same approach might work for other types of problems. This methodology, defined as a *conjecture,* forms the basis for what is known as *Inductive Reasoning.* When one draws general conclusions, namely, when one makes a conjecture, as a result of repeated observations, inductive reasoning results. The problem here is that a conjecture may not always be valid. If only one example does not work using inductive reasoning, then the conjecture is false. In order to establish a conjecture as truth, a process known as *Deductive Reasoning* is used. Here we have the case where general principles are applied to specific examples.

Math Is A finite Number

In any math course that you might encounter, there actually exists only a finite number of different types of problems. To you, the types of problems might seem endless. However, be assured, if you could master a specific group of problems in any math course, you could solve any problem that you were confronted with! As complex as the study of calculus is, there are approximately 250 different types of problems. If an instructor has mastered this finite number of problems, then he or she could solve any problem, using the same principles. I only use this as an example to say that problem solving

is an integral part of mathematics and there is no reason why you cannot establish a strategy to solve both word and standard numeric type problems.

Mathematics is not magical, although at times it may seem to you that your instructor is obviously performing some type of magical trick to arrive at a solution.



On the contrary, your instructor has done so many problems of the type that you are working on, that he or she will use a similar approach to solve yet another variation of the problem. In math, repetitive problem solving is the key to learning how to handle a wide range of problem types.

Types Of Problems

Let's consider two different types of problem situations, numeric or equation type and word problems, that you will encounter. The first will deal with either numeric or equation type problems. No matter what type of math you are taking, your instructor will probably discuss the concepts of the topic first and then proceed to solving actual problems. Pay close attention to the types of problems that are being solved in class. Consider the specific technique used to solve these types of problems. When you are doing the problems on your own, use that same technique and do as many problems as it takes until you become comfortable with that set of problems.

Estimating An Answer

Many algebra students have problems solving simple algebraic equations. A student taking algebra will progress in their techniques for solving one, two and three variable equations. I often encounter students who, in there attempt to solve a single variable equation, will come up with an answer that is far from correct. Not bothering to check the answer, they assume that they used the correct technique for solving the single variable equation. Suppose that in algebra you were given an equation such as:

$$3x - 1 = 8$$

You are looking for a value of X that will make this statement true. If you substitute a nice round number like 4 into the equation, it becomes:

$$3(4) - 1 = 12 - 1 = 11$$

You now know that the number that you are looking for must be less than 4, in order for the equation to equal 8. Obviously, the answer to this equation is X = 3. However, I have had students who are learning the techniques needed to solve these equations and come up with an answer to 3X - 1 = 8 as X = 5. They of course made an error using the technique for solving this equation, but were still confident that X = 5 was the answer. If they would have estimated the answer first, they would have realized that X must be less that 4 and therefore cannot possibly be 5.

If the problems become somewhat more involved, such as equations with decimals:

$$3.2X - 7 = 22.7$$

The use of an estimating procedure becomes even more meaningful.
Round off the 3.2 to 3 and the 22.7 to 23.

The equation then becomes: $3X - 7 = 23$

Since you are trying to find the value of X, if we estimated its value at 9 then the equation becomes:

$$3(9) - 7 = 23$$

or $27 - 7 = 23$

or $20 = 23.$

We can now determine that the solution must be greater than 9, so we try 10.

$$3(10) - 7 = 23 \quad \text{or} \quad 30 - 7 = 23.$$

We now know that the solution must be between 9 and 10. The actual answer is 9.28. If we then solve the equation using the appropriate technique and get an answer of 6.5, we know that we made and error. Of course you can always check your solution in the original equation to determine if it is true, but it is a good habit to get into to estimate your answer, where appropriate, so that you will have a sense of the correct solution.

Considering Problem Alternatives

As I mentioned earlier, continuously ask yourself what if something were changed in the problem? Would that change the technique that you use to solve the problem? This will expand the range of different types of problems that you can handle.

Problem Solution Techniques

Segment each type of problem and associate it with a specific solution technique. Once you have mastered a specific problem type, move on to the next type. In lower level math courses such as algebra, I would be hard-pressed to say that there are any "mind-expanding" problems. All that you find is a multitude of techniques to solve algebraic expressions and equations. Since equations come in many forms, there are specific techniques to solve each form. These techniques have been thoroughly proven and work every time, for the problems that you will be faced with.

Guidelines For Problem Solution

Here are some guidelines and strategies that you might want to consider in learning how to solve both numeric and equation type problems.

1. Buy yourself some index cards and use each card to define a different problem situation.

2. Write a specific problem on a card and on the back of the card, define the method used to solve it.

3. On another card, following this first card, define other problems of the same nature.
   Use the back of the card to indicate the correct solution to these problem variations.

4. Each time that you attend a lecture, observe your instructor's solution method to problems that are discussed. When you get home, set up some new index cards with those types of problems and their associated solutions on the back.

5. Eventually, you will have written a set of cards, that you could carry with you, that will contain all of the problem types and their associated solutions, that you have discussed in class. The mere process of doing this, in addition to re-writing your class notes at home, will significantly enhance your understanding of the subject matter.

6. Be prepared to review these cards on an ongoing basis, adding to them with new types of problems and problem solution.

THE KEY TO YOUR MASTERY OF AND SUCCESS IN MATHEMATICS LIES IN YOUR ABILITY TO NOT BECOME OVERWHELMED BY THE DIFFERENT TECHNIQUES BUT BY ASSOCIATING THEM WITH SPECIFIC PROBLEMS.

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Solving Word Problems

Many students have particular difficulty when dealing with word type problems. Word problems are problems that express in words a specific situation. You then are asked to define that problem situation in a numeric or equation type of format. This major accomplishment requires an understanding not only of the problem as expressed in words but also of the mathematics that you will need to structure the problem in a quantitative manner. Elementary algebra introduces most students to word type problems. I do not want to be given any credit for the "relevancy" of most of the word problems that I see in elementary algebra textbooks.

"If a taxi cab and a steamboat leave San Francisco at 3 P.M., and travel in opposite directions, at what time...?"

They do in fact attempt to develop certain analytic thinking abilities that even *YOU* never thought that you had! Think of it as "often ridiculous" problems, attempting to give you some insight into how to solve "real-world" problems. If you have to deal with these word problems, then you might as well have a plan of action to make "life in the math world" bearable. We can develop a method or steps that you can use to solve any word problem. I take no credit

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for developing these steps but can only reiterate them, adding certain refinements and stress their importance

1. Read the word problem a few times. If the word problem does not make any sense to you, you are probably right! If you cannot quite figure out how you might ever encounter such a problem outside of the classroom, you are probably right again, you never will! But don't tell this to your instructor, just read the problem and read the rest of these instructions.

2. Try to determine exactly what you are being asked to find. Let that quantity be defined as the "unknown quantity".

3. Determine what information you are given from the word problem and write that information down.

4. Consider what technique that you already know, could be applied to this situation.

5. Use that technique and the information given, to establish a strategy for setting up the problem from a quantitative standpoint.

6. For any word problem, consider the use of drawing a picture or table to better represent the problem. This practice will often make a big difference in enabling you to solve the problem. There will be times when you will need to construct a graph to best represent the problem. Here again, be aware of the tools that you have to work with to resolve a problem situation.

7. If a particular approach to a problem does not work, attempt an alternative approach. Even you can be creative with mathematics.

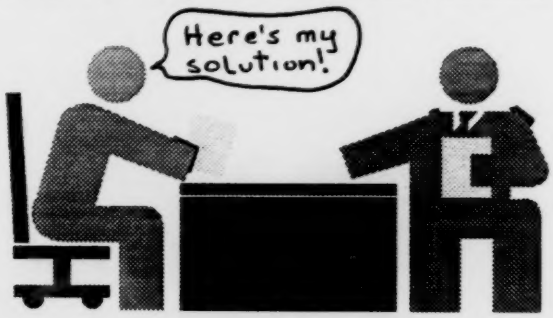
REMEMBER...MATHEMATICS IS A SET OF LOGICAL PRINCIPLES AND TECHNIQUES THAT WILL NOT VIOLATE THE BASIC MATH ASSUMPTIONS AND WILL MAINTAIN THE INTEGRITY OF THE PROBLEM. IT IS THEN UP TO YOU TO USE THESE TECHNIQUES CREATIVELY SINCE A NEW PROBLEM VARIATION MAY WARRANT THE USE OF A VARIATION OF AN ALREADY DEFINED TECHNIQUE. (Sorry about that, but you can handle more than you think!)

8. **Once you have structured a problem in its associated mathematical form, once again read the original word problem to reassure yourself that the structure makes sense and it will give you the results that you are seeking.**
9. **When you do finally arrive at a solution, test that solution to see if it really does make sense. I once gave my students a problem on an exam to determine an estimate of the weight of the human brain. I gave them the information that they needed to perform this simple computation. The response that I received on some of the papers was that a 150 pound person can have a 75 pound brain!**
   Obviously, the computations that they performed gave them this result and they didn't consider whether that result made any sense. Certainly, if they would have checked their answer, they might have gone back and looked for an error in their computations in order to arrive at the correct solution.

10. **Most textbooks come with solutions to either odd or even problems, in the back of the book. In addition, you might be able to obtain a separate student solution manual. If your instructor did not require you to purchase student solution manual, ask your instructor if one exists for your text. If so, see if you can obtain it. It will allow you to check your answers and observe the correct method of solution.**

11. ***The "real-world" does not come with a solution manual!***
    By developing a structure through which you can approach problem solving, you are developing logical thinking habits. These habits and abilities will enable you to resolve problems that you encounter at work or at home.

All of your hard work will pay off in ways that you least expect!



Chapter 16

WHEN YOU NEED TO GET A TUTOR

Do you find that you are experiencing some difficulty with specific math topics that you feel you need additional help with? Are you unable to obtain that much needed help from your instructor or through your ability to ask questions in class? It may be time for you to consider getting a tutor before things get out of control!

Obtaining A Tutor

Obtaining the assistance of a personal tutor in mathematics is certainly nothing to be ashamed of. It would be sad to think, however, that if you did not obtain that assistance, you ended up doing poorly or in fact failing your course. It is a fact that the difficulties that you may be experiencing in mathematics are being experienced by others. Not everyone will seek additional help. Some will rely on the resources that they have available to them such as their textbook, notes and classmates, to help them through specific problem areas. That does not always work since while you are trying to learn a difficult topic, the course still continues and further topics are discussed. Very quickly you find yourself falling further and further behind. At this point, a knowledgeable tutor may afford you the ability to gain confidence

in areas that give you problems, while allowing you to keep up with new material and the pace of the course.

Preparing For Your Tutorial Session

Having a tutor will give you the opportunity to learn in a one-on-one environment. You can get immediate response to specific problem areas. The stress evident in the classroom setting is non-existent. Since you are paying the tutor for his or her time, it is best that you prepare yourself before your meeting to ask and deal with specific problems that you have. This will make your tutorial session more productive. Write out specific problems either from your textbook or notes that are causing you problems. Use these problems to form the basis of discussion during your session. If you choose the problems correctly, the techniques used to solve them and the development of a solution will lead to further discussion and add insight into how to apply these methods to other types of problems.

EMPHASIS ON MAKING THE MOST EFFICIENT USE OF THE TIME THAT YOU SPEND WITH YOUR TUTOR BY PREPARING SPECIFIC PROBLEMS AND CONCEPTS THAT GIVE YOU DIFFICULTY, IN ADVANCE, WILL LEAD TO PRODUCTIVE AND REWARDING SESSIONS.

Knowing When You Need Help

Falling behind in your understanding of the material in any course is something that you don't want to occur. In the study of math and science, it can cause particular difficulties. Unlike certain other courses, the topics discussed in math and science courses are often built upon that which you already learned. As you fall behind in your understanding of the topic, it will become increasingly more difficult for you to comprehend future topics. It is up to you to be aware of your difficulties and make it a point to not let these difficulties remain. No matter where you are or what school you are in attendance at, there are alternative resources available to you for assistance. All you need to do is be aware that you are experiencing difficulties and seek assistance.

In many traditional academic environments, your classes may be too large for you to ask specific questions, let alone dwell on an area that gives you difficulty. Even if a large lecture breaks up into smaller sections, answers to specific problems may still go unanswered. In community colleges across the nation, where classes tend to be smaller than those at four-year institutions, the ability to gain answers to your questions, directly from your instructor, may also be difficult.

You may be surprised to know that many of the students that seem to excel in the subject, already have a tutor. The use of a qualified tutor can make a good student even better and a borderline student develop the necessary skills to succeed. If you are aware of another classmate who is also having difficulties, you may be able to find a tutor who will assist both of you at a discounted hourly rate. A more personal approach to learning can often mean the difference between a good grade and a merely passing grade!

Especially in mathematics, you will know when you are having difficulties. Don't wait for exams to suddenly inform you of your need for HELP!!!

Questioning Your Understanding

As the term progresses, on an ongoing basis ask yourself the following questions:

1. Am I honestly understanding the lecture material as presented by the instructor?

2. Am I able to do the assigned homework problems?

3. Do the other students in the class seem to have a better understanding of the material then I have?

4. Am I utilizing all of the resources available to me such as the textbook, instructor, college math tutorial assistance, organized study groups, alternative textbooks, additional study materials, etc.?

5. **Do the topics presented in the lecture seem to be coming so fast that I can barely understand the last topic when the next topic is presented?**

6. **Am I starting to feel that I am walking on a tightrope in relation to this course?**
   Slowly losing my balance and hopelessly beginning to fall into the abyss of failure?

7. **Would I be able to learn this material if I just had some additional help?**

If you are answering yes to most of these questions, then it is time to consider a tutor!

Don't wait any longer! You probably have the ability to do well. All that you need is to make a minor additional investment in your education and it could drastically change both your outlook and your potential for success.

Chapter 17

CHOOSING THE RIGHT TUTOR

Now that you have decided on getting a tutor, which tutor will be right for you?

Which Tutor Is Right For You?

Do you need a demanding tutor? One that will "forcefully" get you to understand the material? There are tutors out there who work this way. They may be tougher on you than that which you are experiencing in class! Maybe that is what you need! If you need someone who will really structure your study techniques and teach you using "scare" tactics, then consider the demanding type. Obviously that type is not best for most people. What about

someone who takes you through the material slowly, is very understanding and has the patience to dwell on a topic until you thoroughly understand it? Is this the type of tutor for you? Or would you like a person who is trained as an instructor and will lecture to you. However, the lecture will only consist of you and the instructor! Do you feel that you would respond well to this type of tutorial assistance and be able to learn in a one-on-one lecture environment? Consider this idea, a tutor who is so knowledgeable in the subject area that he or she has become a perfectionist who will demand perfection from you. A sort of "computer tutor" who will fully detail every aspect of the material that you are having problems with. This type of individual may in fact give you more insight into the material then you might feel that you need. There will certainly be rewards from this type of assistance but is that what you want?

Finding A Qualified Tutor

There is no lack of people out there who offer their services as a qualified math tutor. Many instructors tutor students privately for purposes of added income or just because they enjoy doing it. Often, you can find a qualified student tutor, who either is a math major or has just done well in the course that you are having difficulty with. In addition, there are numerous organized tutorial services that can arrange for a qualified tutor in any subject area. You might be able to find one of these companies in your local Yellow Pages.

You may not have to go any further then your own school to find a qualified tutor. You might even want to ask your instructor if he or she can tutor you during office hours or outside of the school. If their time constraints does not allow for this, then ask your instructor if they know of a qualified tutor that you can call. Many schools have tutorial assistance programs through which outside tutors advertise.

You may be able to obtain a tutor through the school or by looking in the advertising section of your school newspaper. Possibly a fellow student is already using a tutor who they enjoy working with. You might be able to get that person's name and arrange to meet with them to discuss your problems.

If you want a tutor, you should be able to find one if you make inquiries. The question still remains as to who is the right tutor for you. Consider the fact that you are not obligated to continue with any tutor that you choose if you find that you have difficulty learning from that person. Each individual has their own style of teaching. What works well for another student may not work well for you. If you start out with one tutor and find that it is just not working well, feel free to stop seeing that tutor and seek the assistance of another tutor.

When you find the right tutor, one that you can learn from, teaches you at a pace that you can understand and makes that which you considered difficult, seem simple, then you will regain your confidence and maintain your sanity!

Choosing the right tutor is not a difficult task. However, it will require that you be motivated enough to devote that time to exploring all of the available opportunities for obtaining that tutor. It will prove to be well worth the investment of both time and money, if you acquire the right tutor for you and see the results that you were really capable of doing!

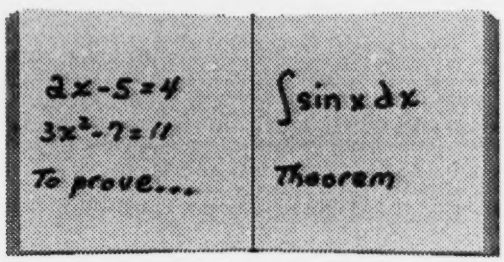
Chapter 18

ABSTRACTION VS. DISTRACTION

Math As An Abstract Language

Mathematics is a subject which is quite different than any other subject that you have or will study. It differs in the approach that you must take to succeed in understanding it. In addition, many of the concepts that you will encounter, will be presented as techniques for solving a specific group of problems. There may not necessarily be any "real-world" applications that are presented to you to reinforce your learning. In view of this, the subject area often seems rather abstract to students. In other words, it seems void of specific applications that might be meaningful to the student in his or her daily life. As you will see in a later chapter, mathematics is in fact a very powerful tool and has a vast number of applications to a diverse set of professions.

It seems only logical that it is much easier to read 10 pages in a psychology textbook than to read 10 pages in a math textbook.



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Emphasis On Concentration

The concepts that you will encounter in mathematics require a concentrated effort to fully understand them. It requires that you do as many problems as it takes until you feel secure in your understanding of the topic. I have had students come to me in frustration when they could not understand a topic and solve its related problems, after hours of study. However, in many instances, when the problem was resolved, they not only felt relieved but exhibited a genuine sense of accomplishment and exhilaration.

Interference From Our Personal Lives

Often times, we bring the stresses and problems of our personal lives into the classroom. This in itself limits our ability to concentrate on the subject matter. In some courses, if our concentration is poor, we might still gain an understanding of the concepts discussed. However, in mathematics, if your concentration is poor, due to non-mathematical thoughts crossing our mind, you are at a disadvantage.

Focusing On Your Studies

Whether you are attending a math lecture or at home studying or doing your assignments, I strongly suggest that you attempt to focus your mind on the subject matter. If you are studying at home and you find that your mind is beginning to wander, take a break! Do something that will satisfy your alternative thought processes and then come back to your studies when your feel that you can concentrate better. There is no point in prolonging your agony if your concentration fails, when you will be better prepared to deal with the subject matter at a later time. As was mentioned earlier, if you form a small study group, you may be more inclined to maintain your concentration level for an extended time period. In the presence of two or three other people discussing a topic or solving a problem, you may not have time to let your mind wander.

Concentrating During A Lecture

If you are attending a lecture and your mind begins to wander to other matters, you cannot as easily leave the room as you could at home.

The first thing that you might want to consider is preparing yourself for the lecture before you enter the classroom. Once you enter the door of the classroom, try to leave all of your personal problems and considerations outside! Realize that you are attending the lecture for only one purpose. The purpose is to gain insight into the subject matter from your instructor. Lectures are not times for writing letters to your friends or relatives or thinking about your job or other family matters.

If you are in a large class, it is easy to loose your concentration since the instructor is not talking directly to you. You might want to raise your hand and ask the instructor a question, even if you already know the answer.

What you are doing here is giving yourself the opportunity of having the instructor address you personally. This event will demand your attention! Following your instructor's response, your attention span should remain with you for a continued time period. If you find that your concentration is failing again, ask another question. If nothing works, asked to be excused from the

lecture, leave the room, and return when you feel that you can again concentrate.

IN THE CLASSROOM, THE WORLD OUTSIDE DOESN'T EXIST!

In mathematics, the lecture material at times, can be rather abstract. It takes significant effort on your part to minimize the number of distractions that will present an obstacle to your learning.

Summary

Let's summarize the points made on this issue of maintaining your concentration:

1. Mathematics can at times be abstract enough to allow for a loss in concentration.
2. Do to the rigors of mathematics, you need to maintain a level of concentration.
3. You need to maintain this concentration level both in lectures and during your studying at home.
4. You need to minimize your level of distractions.
5. You need to convince yourself that your ability to learn this subject will take your full attention.
6. During lectures, the world remains outside and your mind remains attentive to the instructor's comments.
7. At home, attempt to minimize the potential for distractions by allocating a space and time when you will not be interrupted.

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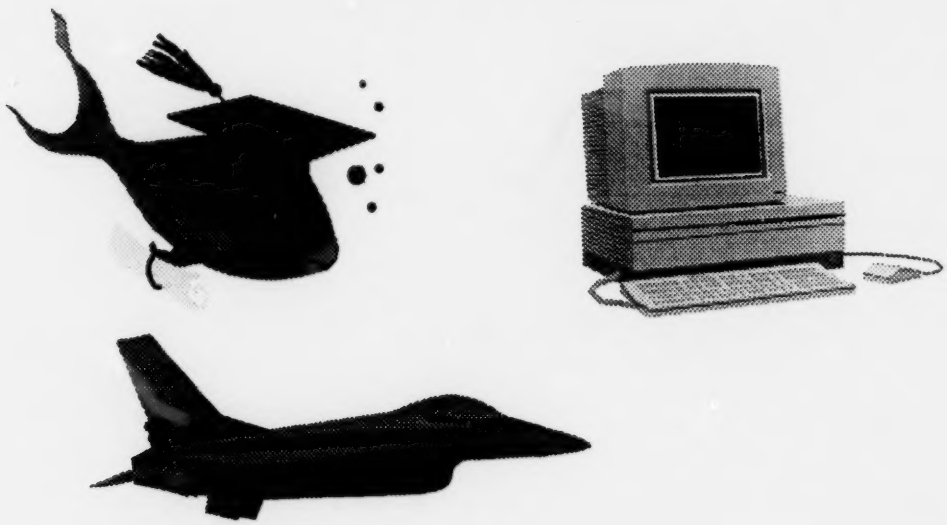
Chapter 19

THINKING MATHEMATICS



You need not feel like a lone fish in the sea, a computer whiz or a "rocket scientist", to think mathematically. The increased knowledge that you gain in math and the ability to think analytically, will make you wonder how you ever lived without it.

Importance Of Developing Analytic Skills

THE CONCEPTS OF MATHEMATICS SURROUND YOUR DAILY LIFE!

While developing this book, I was continuously thinking about what separates the good students from those that have difficulties which leads to both frustration and failure. Certainly, you might say that the good students just have an affinity for mathematics and tend to enjoy its challenges while the poor students find it to be an overwhelming burden in which they see little or no applications. Based upon my experience, I tend to believe that this is not true.

A majority of the students that I have seen, who have succeeded in mathematics, did not necessarily have better analytic skills and a greater aptitude for analytic thinking. But something eventually made the light shine in that "unknown" analytic corner of their mind.

They developed an appreciation of why a knowledge of mathematical principles was important. This factor led them to deal with their difficulties and gain success. They seem to have developed a type of self-motivation, based upon what they considered to be a need for quantitative reasoning. They somehow began to "think mathematically" as evidenced by the nature of the questions that they asked in class, their methodologies used in dealing with term projects and their responses on exams.

Math In Isolation

Students who experienced the most difficulties, never quite developed a means through which they could see mathematics as a part of their lives. They tended to struggle through the course, attempting to learn the techniques and

concepts, with the primary motive of passing the examinations. Unfortunately, mathematics has traditionally been designed this way.

I don't meet very many students who have good feelings about studying mathematics. To most, mathematics has the connotation of being a difficult and useless subject to people other than mathematicians, scientists, engineers and of course, math teachers. Whoever told you this or under whatever circumstances you came to believe this idea, I can firmly state that it has no basis for truth.

Instructor's Responsibility

As you proceed with your study of mathematics, whether you are taking a course in algebra or advanced calculus, try to keep in mind that the concepts that you are learning are going to be useful to YOU! Often, you may wonder how that could possibly be true. When you question it, ask your instructor to show you some applications where a specific topic would apply to your personal life, your career or work, or that which you might encounter outside of the classroom. Many, but not all instructors will welcome this opportunity. It is really your instructor's responsibility to inform you of not only how you can use what you are learning but also of the many rewarding careers that a knowledge of mathematics will prepare you for.

Unfortunately, many instructors will not take the time away from the actual topic discussion to deal with anything other than textbook problems. I need to state that when I discuss related applications that are not in the book, I encounter many students who literally become terrified! They ask why they need to know this and why we don't just "stick to the book". That's the problem! Most people have a difficult enough time with math and certainly don't want to "tax" their brain on any ideas outside of just learning a math technique and reiterating it on an exam. However, the time has come to realize that mathematics is <u>not</u> an isolated subject area, tucked away in deep space, which you were never able to and will never be able to understand.

Math Mode

If you want to succeed in your math course beyond that which you ever dreamed possible, and you want to make it an *"enjoyable"* and *"enlightening"* experience, I strongly suggest that you follow a relatively simple course of action. For the duration of the course, put yourself into "math mode". Begin the course with the attitude that you can succeed and the basis for your success will be an understanding for the first time in your life, of why you need to know this material. Discuss it with your classmates.

When you read a newspaper or magazine, don't skip over articles that are analytic in nature. If you read these type of articles, that will in itself change your attitude. Discuss these articles with your peers. If you currently have acquaintances who shudder at the thought of discussing anything that seems technical, make some new acquaintances! You need people around you who will not only support your learning but will share new thoughts with you.

The environment in which you accomplish your daily tasks, whether that is at home, at work or at your local supermarket, is becoming increasingly dependent on modern technology. The basis for many of those technologies was born in the mathematics that you are learning!

Be Aware! Be Confident! Be Successful!

Chapter 20

MATHEMATICS IN THE PROFESSIONS

The Educational Testing Service(ETS) Report

In September, 1993, a 150-page survey conducted by the Princeton-based Educational Testing Service(ETS) and released by the Department of Education, reported that roughly 90 million Americans over the age of 16 - almost half of that category's total population - are, as far as most workplaces are concerned, basically unfit for employment.

Included in that definition are those who can sign a credit card receipt but who are incapable of writing a letter when they think their bill is wrong; those who can pay the correct change at the supermarket but have difficulty calculating the difference between regular and sale price; those who can scan a newspaper story but cannot paraphrase its contents. If the ETS survey is accurate, it would lead us to believe that the U.S. population is not only significantly populated by people unprepared for current and advancing technologies, but most of them do not know that they do not know!

Mathematics And Tomorrow's Jobs

I continuously debated whether or not to include this chapter in this text. This book was designed as a guide to learning mathematics successfully and originally not intended as a guide for obtaining a job that uses mathematical concepts. Oh no! Did I say a job using math? For most of us, it is burdensome enough to take a math course let alone consider the possibility of choosing a career that heavily relies on its use! However, if you have not realized it as yet, mathematics plays an integral role in most job related activities and too many of us are not prepared to handle even basic computations. To be successful in

jobs of the future, the employee of tomorrow will need strong abilities in analytic concepts. No, the average employee will not need to understand and be able to apply sophisticated concepts in calculus, unless they are employed in a position that demands such skills. However, we will all need a strong capability to deal with and apply numeric computations to a diverse set of applications.

Mathematics In The News

Newspapers and magazines often report the use of mathematics. It can be seen in everything from errors in the Federal Government's recent census and defining equations to predict the salary that a baseball player should be paid, to sophisticated math concepts such as Chaos Theory and how it is applied to predicting the behavior of the weather, the inner workings of the human body and the ebb and flow of wildlife populations.

Can you think of any professions within which you would consider mathematics to play an important role?

Certainly, there are many! Consider some of the professions that use mathematics to varying degrees. Let's consider some, briefly define the profession and attempt to determine the extent to which mathematics is used. I did not intend for this list to be all inclusive. If your specific career or profession is not listed here, think about how the math that you are trying to learn might play a role in your career. You might just answer your own questions as to the relevance of a knowledge of mathematics.

Description Of Professions Using Math

The following are just a few of the many professions that use mathematics, from basic computations to sophisticated equations and analysis.

ACCOUNTING	*FINANCE AND BANKING*
ENGINEERING	*BUSINESS*
ACTUARIAL SCIENCE	*COMPUTER SCIENCE*
STATISTICIAN	*ELECTRONICS*
REAL ESTATE	*HEALTH SCIENCES*
	LAW

Accounting

According to Webster's New Collegiate Dictionary, Accounting is the "system of recording and summarizing business and financial transactions in books and analyzing, verifying, and reporting the results". Does this sound like working with numbers to you? Think about how much people depend on accountants to make correct computations when they are preparing their taxes. Today, computers are heavily used to assist accountants in tax and other financial preparations. Computers usually don't make mistakes! However, an accountant needs the ability to make computations for clients without the use of a computer. Many of us depend on an accountants accuracy and knowledge when it comes to our personal financial well-being.

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Consider that the use of computers allows accountants to perform even more sophisticated computations and analysis. Even though the computer can do the computations quickly, the accountant must understand what the computer is doing and why the computations are important.

It is easy to see why mathematics, and the ability to make basic computations with numbers, plays an important role in the field of accounting.

Engineering

Engineers use mathematics in all aspects of their work. Through years of study and increased emphasis on developing their mathematical abilities, engineers are able to apply their training to a diverse set of problems. As an example, structural engineers continuously use concepts of algebra, trigonometry, geometry and calculus in their daily work. Applications of these branches of mathematics are easily seen in everything from the construction of houses to nuclear power plants.

Most of us throughout our career will never use mathematics to the extent that engineers do. However, just think of all of the things that we see everyday that are the result of engineering work and how important many of these things are in our daily lives.

Actuarial Science

An Actuary is one whose job it is to calculate insurance and annuity premiums. An Actuary is also involved in work relating to a wide variety of statistical calculations. Actuaries make calculations regarding life expectancy for insurance companies. Life insurance premiums are based on their computations. The insurance that you pay on you car is based on computations relating to accidents, cost of repairs, theft and vandalism, and geographic location. Actuarial Science is the study and development of these types of computations.

An actuary needs a strong mathematical background, especially in the area of statistics. Actuarial work often involves the development of quite sophisticated equations to represent a diverse set of circumstances. Indeed, an actuary's work and mathematics are closely related.

Statistics

By definition, statistics are facts. These facts can be either quantitative or qualitative in nature. By that I mean they can be either numeric or non-numeric. Whether we are reading the newspaper, watching television, listening to the radio or at our favorite sporting event, we are constantly presented with statistics. These statistics can take many forms. They can exist in a table format, a graph, a word statement or even a cartoon presentation. We derive information from the statistics that we see.

If one is a sports enthusiast, that person may read the sports pages on any given day, of their local newspaper. There they will find sports scores, player statistics, and other information relating to team standings. These are all statistics. They were compiled by team statisticians, whose job it is to collect, analyze and report this information to the public as well as keeping records for the team management.

If one ventures into the business section of a newspaper, statistical data in numeric format is very evident. You see it in relation to stock prices, % changes, financial data, charts, graphs and tables. Numbers at work!

If you go to your local library or bookstore, you will find the latest copy of the World Almanac and Book of Facts. This book contains data and information of all types, with a significant portion of it devoted to numeric data. People use this information to enhance their own knowledge of a particular subject area or as a basis for further research and analysis.

Without a working knowledge of basic mathematics such as computations and presentations involving percents, ratios, fractions, averages, decimals and how to read a graph, your understanding of such information would be severely limited. Your development of mathematical thinking will give you the ability to converse intelligently with your peers in your chosen profession as well as enhance your understanding of information that you are confronted with daily.

Real Estate

The field of real estate has long been an exciting and lucrative area. Whether one is an investor in real estate or works in the real estate business as a builder, real estate salesperson or mortgage banker, mathematics is an integral aspect of their daily work. An investor in real estate needs to make financial decisions relating to the purchase, sale or financing of a given property. An investors decision analysis can involve a wide variety of variables, alternative analyses, and often complex tax considerations. The name of the game is to make money on your investment. With the help of computers, very sophisticated analyses can be accomplished.

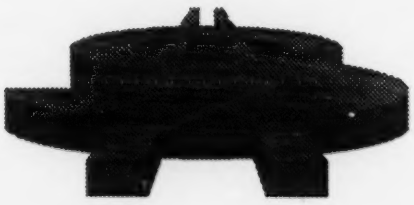
Builders must consider financing strategies, cost factors, and timing in their quest to build either a house, a new shopping complex or a 60 story office building.

Real estate salespeople and mortgage bankers need the ability to handle computations that deal with property financing. They need to make computations which consider interest rates, alternative financing strategies, client loan qualifying and numerous other analytic computations. Factors within the economy can affect the real estate market and make the computations even more complex as well as promote a need for new and "creative" financial strategies. Just go into any bank and speak with a loan representative. It isn't long before you will be overwhelmed with the various options and considerations involved in the purchase of a property. Interest rates, ratios, equations, amortization schedules, adjustable rate mortgages, indexes, charts, graphs and balloon payments...all math.

BUT ALL THAT I WANTED TO DO WAS BUY A HOUSE!

If you are going to depend on and trust others to do computations for you, you may find yourself in a situation prone to errors! Whether you work in the real estate profession or seek the advice of real estate professionals, either way you will find an increasing reliance on mathematical computations.

FINANCE AND BANKING



When you walk into a bank, you are immediately confronted with numeric information. Banks do not only take your deposits or handle your withdrawals

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but are also involved in sales. They attempt to sell you a mortgage for a house, Certificates of Deposit for investments, Bonds, credit cards, and of course loans. All of these have numeric information attached to them in the forms of loan rates, interest rates, alternative mortgage rates, and other financial related data. This information is developed by people who work in the financial sector and sometimes one wonders if the majority of "outsiders" really understand what they are reading.

If one applies for a home loan, the bank lending officer will inform you of all of the different types of loans available. Do you want a fixed rate loan for 15 or 30 years or how about an adjustable rate mortgage with a starting rate of 2.7% and a lifetime cap rate of 8.5% with a balloon payment after 10 years! What happens when the bank presents you with their financial criteria for evaluating your loan application. What comments or corrections will you make when they state their "front-end" and "back-end" percentage ratios and ask you for a full financial statement? Can you handle the math involved? Banks and financial institutions rely heavily on the use of mathematics in their daily business.

When you go to your local car dealer to purchase a car, what happens after the decision is made as to the type of car that you want?

You then sit down with the sales or finance manager and discuss the financing options.

The finance manager for a car dealership is well equipped to give you all of the information that you need. Would you prefer a three, four or five year loan? What interest rate are they able to finance you at? What effect will this rate and the length of the financing term have on your monthly payment? What about a lease option? What are the differences in your downpayment and monthly payment schedules in a lease vs. buy situation? Again, mathematics at work! Do you feel confident that you can make an intelligent decision when confronted with these options?

YOUR STUDY OF MATHEMATICS WILL GIVE YOU THE TOOLS THAT YOU NEED TO OPERATE IN THE SOPHISTICATED FINANCIAL WORLD IN WHICH WE LIVE! IT WILL ALLOW YOU TO SPEAK WITH CONFIDENCE, UNDERSTAND THE INFORMATION THAT YOU ARE PRESENTED WITH AND MAKE SOUND FINANCIAL DECISIONS!

BUSINESS

We have already looked at Finance and Banking which is business related, but now let's look at some other forms of business where mathematics is used.

In today's competitive marketplace, business owners and management must run their operations efficiently be constantly aware of changes in the marketplace. All employees of such companies must also have the skills to accomplish their respective job tasks effectively and continuously enhance their skills in an ever-changing business environment. The Bureau of Labor Statistics(BLS), periodically comes out with extensive reports on the nature and future of the job market in America. They have recently come out with a report on fields of employment that will lead job growth from now through the year 2005. But in these fields, as in all other fields, the skills that people have will have to be continuously redefined. From their report, "Employees who can adapt will have broader scope for their creative talents. Those who cannot keep up risk unemployment".

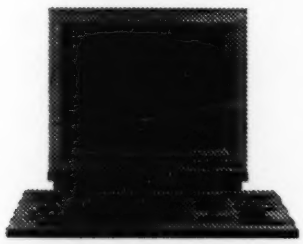
Consider the school that you are attending in relation to a business. Your school has operating costs that are met partly by tuition funds, state or local funding and possibly private donations. Most schools today have a staff of people who actually run the day-to-day financial operations of the business. They are involved in evaluating the cost of doing business, funding sources and new sources of revenue. Lengthy financial and operating statements are produced on an ongoing basis for presentation to state and local authorities as well as for public knowledge. The use of mathematics as a tool for business problem solving is critical.

Depending on the type of business, the degree to which mathematics is used will vary. As was mentioned previously, an insurance organization is constantly analyzing numbers. People within the insurance industry need strong analytic skills. In banking, we have already defined the role that mathematics plays in their daily operations. If you are currently working, can you think of the role mathematics plays in your own business?

Without analytic tools and the ability to collect and analyze numeric information, businesses would literally be unable to operate!

COMPUTER SCIENCE

Over the last decade, the use of computers has had a tremendous increase and impact on both businesses and our personal lives.



We are becoming increasingly more dependent on computers in assisting us in everything from our daily shopping needs to NASA's Space program.

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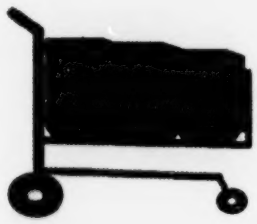
Professionals in this field use mathematics heavily in the development of computers and related devices. Their work eventually effects us in the way that we live.

It used to be that when we went to the supermarket, when it came time to check out our items, the checkout person would add up or weigh each individual item.



Now, most stores are equipped with scanning devices that read bar codes off each product that we purchase. The price of the item is then automatically entered into the store's computer and the main inventory list is updated by the deletion of those items. The store manager can then read this list at the days end and determine exactly what was sold on that day and what items need to be restocked. Computers serve to assist the store manager in the decision making process. Whatever further analysis needs to be done is made easier through the use of these devices.

Many of us who have and use computers and are familiar with spreadsheet programs, know that mathematics plays a role in the use of these software applications. A spreadsheet is established as a mathematical matrix whereby we enter data within "cells" of the matrix. We can then develop everything from our own personal budget statement to sophisticated corporate financial and tax schedules. Within the confines of a spreadsheet or programming abilities in general, we have the ability to do many different types of mathematical computations which is some instances would be impossible to accomplish without the aid of a computer.

It is easy to see that mathematics plays a critical role in both the development of computer equipment and the use of computer systems and software by the

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public. For your information, according to a Bureau of Labor Statistics report, there are two large forces that will transform job prospects in the coming decade. According to the report, "The marriage of fast changing, ever cheaper technologies in computers and communications will alter every enterprise from accounting firms to yogurt makers". This is one of the fields that is projected to lead job growth from now to 2005!

ELECTRONICS

Did you ever wonder about the mathematics that went into the development of that VCR that we all could not live without? I doubt whether you have. Most people use electronic equipment either in their car or at home, but are not really concerned about the technical aspects of the device. Its bad enough that many of us are still trying to figure out how to program our VCR's according to the wording in the manual!

In the field of electronics, mathematics plays a role as the basis upon which most of the devices we use can operate.

Our hand-held calculators are full of equations and programming statements that allow us to harness the power of computers in our hands!

Our stereo systems, televisions and microwave ovens all have a basis in mathematics. If you are interested in the field of electronics, plan on taking quite a bit of math to prepare you to assume responsibility in this exciting field. Given the fact that we have the availability of hand-held calculators, they are becoming an increasingly important tool in education. Students both on the elementary and college level use these calculators to assist them in a wide variety of computations from basic addition and subtraction to the analysis of loans and calculations in trigonometry. New scientific graphic calculators opened up a whole new set of possibilities for the both student and professional use.

The use of mathematics holds the key to future developments in the field of electronics. Sophisticated applications of math will prompt the development of electronic devices in the future that will attempt to make our lives easier and our work more productive. However, as in the case of programming your VCR, one wonders if sometimes our lives are not becoming more complicated!

HEALTH SCIENCES

Do doctor's, nurses, and other medical personnel use mathematics? The answer is an obvious "YES"! Mathematics plays an important role in the ongoing medical practice of doctors, nurses and medical researchers.

Let's consider a branch of the medical field such as pharmacy. A pharmacist must be able to make accurate measurements and weights since any innacuracies or errors can have serious results. A pharmacist must be able to use various types of devices such as precise weighting machines, accurately calibrated measurement tools and other instruments that depend on the pharmacists ability to think in terms of numbers. In addition, the pharmacist needs the ability to handle both English and metric conversions. The metric system is much better suited to deal with the weights and measurements that a pharmacist uses, then the English system.

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Medical research studies rely heavily on the use of statistics to enhance their validity. When results of these research studies are reported to the public, they often contain information as to how the research was conducted and often display the results in charts, graphs, tables or statements using statistical terminology. Through the study of mathematics, we are better prepared to understand these statements, and consider how the results affect our lives.

When a doctor tells a nurse to administer 2 ml of a certain drug, intravenously, to a patient, that means 2 ml and not 2.5 ml or 4 ml! Nurses and hospital need to have a working knowledge of these measurements since there is no tolerance for error!

When a person undergoes a heart operation, that person is temporarily attached to a machine that, for the duration of the operation, acts as his or her heart. It pumps blood through the body at the same rate and pressure that the person's heart would. Consider all of the engineering work that went into the development of such a machine. Numerous considerations, especially those relating to fluid pressure, had to be analyzed before such a machine could be used. These considerations involved the structuring of mathematical equations to simulate changes in blood flow throughout the body as it traverses the endless veins and arteries. Without the use of mathematics, and its relation to fluid dynamics and equations that define pressure changes, this life saving machine would not be a reality!

For your information, occupational forecasters at the Bureau of Labor Statistics expect health care careers to grow faster than most, as they did in the 1980s. According to BLS, demand will be greatest for managers of health care networks, nurses, home health aides and outpatient therapists. Further, according to the BLS, "Nursing will grow in both size and stature. BLS forecasts that careers in the field will expand by 44%".

As you see, the field of health sciences uses mathematics extensively. Possibly, the course that you are taking will note some applications to the medical profession.

Law

What possible applications are there from mathematics as it relates to the legal profession? When one thinks about the work that lawyers do, the things that come to mind relate to the analysis of prior cases, defense and prosecution strategies, huge volumes of law books and years of study. Where's the math?

Lawyers often use statistics in the courtroom to prove their case. They also often use charts and graphs to display information to the judge and jury. One group of lawyers that heavily rely on mathematical computation are tax lawyers. The Bureau of Labor Statistics predicts that growth will be strong for tax attorneys through the year 2005. The Federal tax law is highly complex and tax attorneys need to both understand it and analyze its effects on their clients. Through their understanding of the numeric computations relating to taxes, and the aid of computers to assist in structuring complex spreadsheets and financial statements, tax attorneys can determine the effect of the existing law and changes in the law, to advise their clients accordingly.

So even law does not escape the rigors of mathematics. If it did that would certainly be a crime!

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In summary, choose your profession wisely, but be aware that there are few if any, professions or careers that you might enter, that will not involve your understanding of mathematical computations. Whatever level of mathematics that you are studying, know that you are enriching your life through the knowledge that you are gaining and will be better prepared to handle the job tasks and your own personal matters, that will become evident to you in the complex

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Conclusion

I hope that you have determined by now that your success is within your control and a product of your effort. All that you need to do is establish specific strategies for yourself that when applied, will allow you to reach your goals. This book gives you those strategies and offers insight into the what you will encounter and how to best deal with your attempt at success in mathematics.

This book however, is not a storybook. It is intended as a guidebook. If you fail in your awareness of the items presented and fail to follow the strategies suggested, the probability of your success is diminished. Some students already have skills that have allowed them to be successful in their coursework. We can learn from them since success leaves clues! It is not necessarily an intelligence factor or an aptitude for a specific subject that is solely responsible for your success. You may just need to refresh your skills or change them altogether. It is up to you to determine the type of individual that you are and the needs that you have. This determination can be based on your past experience as well as your honest opinion of whether your success in math could better be achieved through an upgrade in your existing skills and an enhancement to your informational knowledge base. That informational knowledge base consists of those elements outside of the pure subject matter but none-the-less critical in your pursuit of perfection!

When you see positive results, the time and effort that you spent in achieving those results will be well worth it. Trust me, I teach math!

I personally wish you the best of luck in your effort to succeed, but luck coupled with your personal determination and commitment to success will make your goals a reality.

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